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ENGINEERING AND MINING JOURNAL-PRESS

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Will a Copper Tariff Help or Injure the United States?

By F. W. Paine

The Bogey of Cheap South American Copper

By Arthur Notman

Proposed Platinum Stamping Act Legislation

By J. M. Hill

Rio Tinto as Seen by the Camera

By Arthur L. Walker

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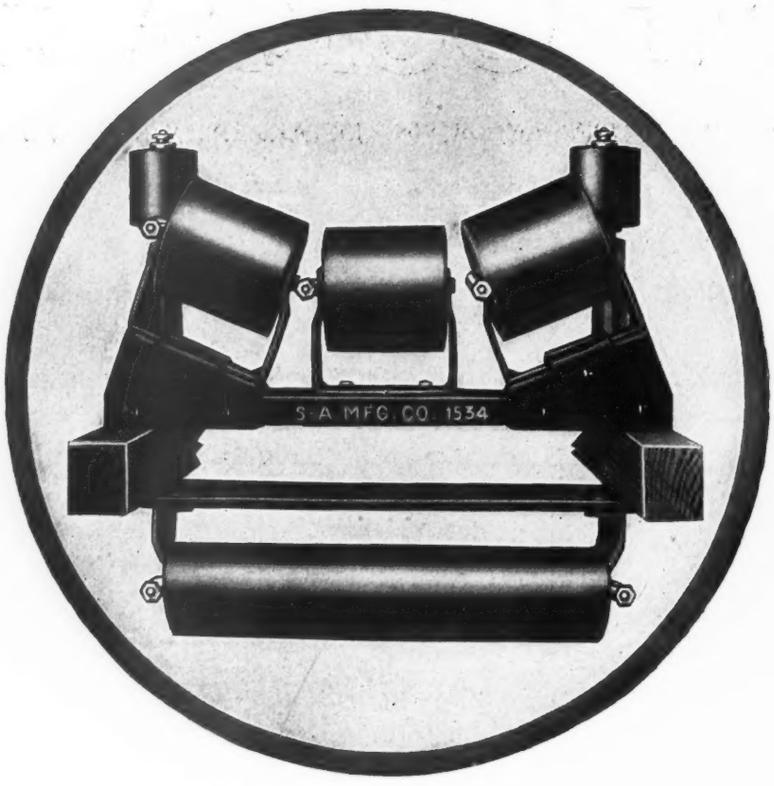

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

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The Mining Engineer in Other Fields

STUPIDITY is exemplified by the bird who buries his head in the ground when a sand storm is in progress, and thus is able to persuade himself that nothing is happening. Similarly, it is unwise to pretend that changes are not taking place in mining that affect those who gain their livelihood as consulting engineers, technical operators, or executives. Mines become exhausted in time; let us admit the fact. Further, the increasing tendency toward the amalgamation of properties and the concentration of operations in large units necessarily results in the thinning of the ranks of the executive, consulting, and technical personnel. In the large mines of today a single consulting engineer may be ultimately responsible for an output of metal that might have helped to support a dozen or more of his colleagues of a decade or so ago. The mill superintendent of a modern plant can as easily control an output of 20,000 tons per day as ten of his predecessors could control an equal number of smaller plants. The consequence is that the shiftmen and subordinate executives are realizing the technical nature of their responsibilities, and taking their places in the general scheme of things, recognizing the need of keeping in close touch with scientific and engineering developments.

The remarkable expansion in specialized education and the success of the technical journal as a medium of information and inspiration in recent years has been responsible in large measure for bringing the members of the staff of operating companies to a common ground of understanding; and it is being recognized that, in so far as the man ahead is a factor, promotion is more likely to result from pushing him forward than pulling him down.

A survey of allied industries shows the success attending the efforts of mining engineers who have taken up other branches of technical work. In going over a vegetable-oil plant recently we were struck with the neatness of design for processing, conveyance, and control; and we complimented the operating executive, who was mainly responsible. His reply was significant: "Well, it came easy. You see I was formerly a mining engineer." At a recent dinner of the American Ceramic Society a remark led to a hasty survey of former affiliations of those present, and the number of ex-mining engineers present was noteworthy. All had done well in their new spheres of action, bringing new ideas and fresh vigor to general industrial work.

Experience in mining engineering is a valuable asset to any man, and a change of occupation is not to be decried. We have only one life to live, and the old adage about the shoemaker and his last fails to convince when the ever-widening scope of technical endeavor is realized. These comments were prompted by the receipt of an appreciative letter from a subscriber in the antipodes to *Mining Journal-Press*. He reminded us that his subscription expired at the end of April, for which, he says, "I have received full value and a lot more." He then explains that he is giving up mining engineering work in favor of commercial enterprise, and concludes with a tacit recognition of our humble efforts, so simply phrased as to be especially welcome: "I thank you for the pleasure and value received." The tribute is all the more significant because the one who pays us so graceful a compliment is unknown, personally, to us. To him and to others who carry the prestige of mining engineering to other fields of endeavor we wish a successful future and full opportunities for the application of those qualities and capabilities that synchronize with successful mining endeavor.

Improvements in Copper Ore Concentration

ONE OF THE LATEST and most important steps in the progress of the art of ore treatment is exemplified by a statement contained in the annual report of the Phelps Dodge Corporation relative to the work of the Moctezuma concentrator: "The outstanding feature of the year's work at the concentrator was the rapid and very satisfactory progress made by that department in the application of selective flotation to the concentrating ores and the double cleaning of flotation concentrates, resulting in sending to the tailings pond over 200 tons per day of pyrite, silica and alumina previously shipped to the Copper Queen Reduction Works." In other words, the grade of the copper concentrates was doubled and the quantity halved, thus reducing freight and smelting charges to a corresponding extent. Undoubtedly a great economy resulted.

This advance turns the attention of metallurgists to the cleaning of concentrates by the judicious application of flotation or by so modifying the flotation treatment scheme as to pick out the copper mineral with a minimum of accessory gangue and sulphide minerals. The nature of the sulphide minerals and the presence of gold and silver establish the limits of the new method in a particular case. If gold and silver are intimately associated with all of the sulphide minerals, it is obvious that the cleaning of the concentrates with respect to accessory gangue is as far as the metallurgist can go. If gold and silver are associated with the copper minerals and not with the accompanying pyrite, the pyrite can be dropped in the cleaning process or prevented in a measure from getting into the primary froth. In the absence of gold and silver it becomes possible to prevent the floating of pyrite, or it can be partly removed by several cleaning stages.

Chalcopyrite contains 35 per cent copper. If this be the important copper mineral, the grade of the final concentrate should approximate 35 per cent as closely as possible. All accessory pyrite reduces the grade. A grade of 17.5 per cent indicates 50 per cent pyrite in the concentrate. With chalcocite, which contains 79.8 per cent of copper, the possibilities of increasing the grade of the copper concentrate are increased.

The important point is a thorough appreciation of the constitution of the ore with reference to the distribution of metallic content. The milling operation is not complete until the minimum quantity of concentrate commensurate with a proper recovery is attained.

Smelter requirements must also be given consideration. The possibilities of saving in freight and in smelting operations and smelter equipment by reducing concentrate quantity to a minimum are therefore worthy of extended research in particular instances.

The Proposed Copper Tariff

GREAT INTEREST is being shown in the proposed copper tariff; so important has the matter become that we have disarranged our scheduled articles somewhat to make room for two papers bearing on this subject in this issue. Mr. Notman's article is supplementary to that written by him which appeared in our issue of June 30, 1923. He shows that if all the factors are taken into consideration, the cost of producing copper in South America is not so low as it is popularly supposed to be and concludes that the dire predictions of a flood of imported metal, which will result in shutting down most of our domestic producers, is not likely to be realized. The fact remains, however, that the growth of imports has been a very real one, and even should no more large foreign properties be brought to the producing stage in the near future, the metal that is being produced by the Chile, Braden, Cerro de Pasco, and Katanga companies is taking the place of a lot of good American copper. Nothing can be done about it, however; it is going to be produced, and if it does not come here it will go somewhere else, taking the place of copper that would otherwise be produced from United States mines.

We are glad to publish the article by Mr. Paine, who is strongly in favor of the tariff, like most of the Michigan producers, even though we cannot agree with all that he says. For instance, Mr. Paine compares domestic mine production, which he estimates at 130,000,000 lb. monthly, with domestic deliveries of 149,099,000 lb. per month, the average of the first quarter of 1924, and concludes that the United States is not now producing as much copper as it needs for home consumption. Two important factors are here overlooked. In the first place, an important tonnage is returned to the smelters as scrap, and this amount should be added to the amount of new copper if the production and domestic shipments are to be compared. In 1922, the last year for which figures are available, an average of 24,000,000 lb. of copper per month was recovered from scrap. In the second place, an important part of the copper reported as "domestic shipments" is worked into wire, rods, sheets, or more highly manufactured forms, and exported. This should not be considered as domestic consumption.

We believe that the only way to tell whether or not we have an exportable surplus of copper is to compare imports and exports of copper in all forms. Unfortunately, it is not possible to do this with entire accuracy, as the copper content of brass and bronze is not reported by the Department of Commerce, and the copper in many manufactured articles, which are chiefly exported, rather than imported, is not recorded. But we believe the following figures, which are compiled from the reports of the U. S. Department of Commerce, are as accurate a record as is obtainable:

	Imports, Pounds	Exports, Pounds
1923		
First quarter	141,685,000	198,850,000
Second quarter	197,999,000	194,500,000
Third quarter	194,831,000	210,100,000
Fourth quarter	177,556,000	238,500,000
1924		
First quarter	206,160,000	271,300,000

These are directly quoted figures except that we have estimated that of the brass and bronze reported 80 per cent is copper. Plainly, we still have an exportable surplus, and instead of decreasing, it has been markedly greater during the last six months than it was during the first six months of 1923. If European conditions improve, as now seems probable, we feel that our exportable surplus is likely to increase further.

We are also in receipt of a thoughtful letter from another Michigan producer, which was not written for publication, however. His principal points are that the present prices of copper are unjust to the producers, which we grant; that if other industries are protected copper has a right to be; that the use of copper should be further stimulated, which certainly we endorse; and that our surplus should be dumped in foreign countries at whatever it will bring, a system which has our strong disapproval.

Briefly stated, our position is this: We are heartily in favor of any reputable steps by which the price of copper can be made comparable with that of other commodities. If a tariff will do this, by all means have it. The copper producers are certainly as much entitled to it as the lead or zinc producers, or most any other protected industry. Our point is that so long as we have an exportable surplus of copper (and we do not yet see that we shall not have in the near future), a tariff can no more increase the price of copper than does the tariff on zinc increase the price of that metal. We believe that if the copper producers think a tariff a solution of their difficulties they are mistaken, and that they should not count on it.

Investments in Mining

WE MUST NOT COMMIT the triteness of repeating the statement of the fact that mining is a basic industry; that it is essential to civilization; that it is morally one of the cleanest forms of business activity. Our business, as the world's most representative journal of the mining industries, is to reflect conditions accurately, and so report them. It is to our advantage to have the use of metals increased, to have new mines opened up; to have as much capital put into mining as the industry needs.

Most mining enterprises contain a greater or less limit of risk; so, for that matter, do other industries; but the average investor prefers to have a certain reasonable speculative element in part of his ventures. No one should condemn a mining enterprise because it is a gamble. All of the sure things, in mining and other industries, vanished long ago from our fair land. But the gamble must be a fair one and a shrewd one, with the investor's money and his judgment on the one hand, and the complex moods and chances of Mother Nature and Lady Luck on the other. No human parasite must tap the stream of funds before it reaches the earth and take a heavy toll for no services rendered, or even make off with the whole. No enterprise must

be promoted which has as its only, or even its chief, or even its subsidiary, object, this tapping process. The owners of such busy brains are not only parasites, they are common thieves, and enemies of the mining industry. The world would be far greener, the sun much brighter, the mining much deeper, if they were all conducted into the lethal chamber for capital offenders at Reno.

Here, apparently, is a simple statement to which all would agree; and a simple policy for us to follow, of which all would approve. Not so. Who, then, will object? The parasites themselves, a brazen, windy race, shifty and hard to kill. Their words are honey to the ear of the public; the toiler listens to the saga of riches and his hand goes beatifically to his breeches pocket. A thousand will listen and yield up to them where one, not without a certain boredom, reads what we write. They offer financial salvation; a five-dollar gold piece for two cents. And what have we to offer? Advice—a non-negotiatiable commodity of which there is a chronic overproduction and not even a chance to dump abroad!

Nevertheless, we trust we have made our policy clear; and we will, so far as we can, hew to this line. We invite, therefore, the continued hostility of all the rich and influential parasites of the mining industry, and those who, less shrewd, are struggling to pocket enough of the public's money, without going to jail, to become formidable and chesty; and we solicit the continued hostility of their friends and of the prostituted journals, mining and otherwise, who are paid to ballyhoo for them.

Warning to Crooked Brokers and Promoters

THE RECENT CONVICTION of J. J. Eiseman and his associates in San Francisco after two long-drawn-out trials in which no trick or device on the part of the convicted was left untried, serves as a warning to crooked brokers and promoters in general. The Bankers Mortgage & Discount Co., sponsored by Eiseman and his associates, was organized in Nevada and sold a "debenture" note of $100 face value and stock of $100 par value in units of one debenture note and two shares of stock for $300. Through the manipulations of the company and its subsidiaries the promoters depleted the assets behind the securities with a face value of $300 to less than $100. Close to a million dollars' worth of securities was sold in California "in defiance of the California State Corporation Department." The lesson back of this conviction is that stock jobbers and manipulating promoters can be convicted when they violate the law.

Next time we shall hope for swifter justice. It is unfortunate that the promoters were able to sell a million dollars' worth of stock before the authorities could stop them.

Expectation and Realization

IN THE recently issued annual report of the Nevada Consolidated Copper Co., operating at Ruth, White Pine County, Nev., the following interesting statement relative to the tonnage and grade of the Copper Flat orebody occurs:

"The assay plans indicated a total of 26,818,200 tons of ore of 1.556 per cent copper fully developed. Of this expectancy tonnage there has actually been mined and shipped 30,701,796 tons of ore of 1.55 per cent copper. This is in excess of 3,883,596 tons over expected tonnage determined from original development assay plans, being 114.48 per cent of expectancy tonnage mined, 99.61 per cent of expectancy grade, and 114.04 per cent of copper content."

In our opinion the outcome of this part of a large mining enterprise is important in that it shows that, where boring and sampling are carefully done, the indicated results both in tonnage and grade are reliable. Undoubtedly the porphyry copper deposits are especially favorable for this method of development. Although this has been conceded, the proof of it in this as well as other instances is well worth recording.

Metals, Money and Prosperity

IT IS SIGNIFICANT that the contraction in amount of national currency—of gold or of paper backed by gold or something of tangible worth; something that will buy anything and everything in the marts of the world—is always coincident with an economic decline and often a forecast of disaster. It is immaterial whether or not the gold is in circulation. It matters nothing whether or not advantage is taken of the government's promise to exchange paper money for gold; inaction in this respect merely indicates that the people have confidence in the national stability.

There is ample historical evidence to show that the failure of mining or the diminution in metallic reserves has been the signal for economic decay. Ancient Rome furnishes an excellent example. The silver discoveries in Mexico and South America had a very potent effect on the countries themselves and also on the nations that absorbed the output. The rise of Great Britain has been due largely to the accumulation of metallic currency and the success of mining operations all over the globe; her decline in recent years has been coincident with a diminution in metallic reserves. The economic chaos in Germany may be traced directly to the absence of currency of international trading value.

With the obvious facts in history available, it is difficult to appreciate the positiveness with which the abolition of gold as a standard is recommended by some as a cure for economic instability. Early in 1922 Mr. Ford suggested the issuance of national paper money, backed by nothing more tangible than the undeveloped water-power resources of the South. More recently, Mr. J. M. Keynes, well known as the author of "Economic Consequences of the War," has published another book, "Monetary Reform," in which he affirms that the gold standard is a "barbarous relic" that is now "remote from the spirit and requirements of the age."

No logical alternative to the gold standard has been suggested, and those who advocate its abolition would do well to study history and note the close harmony that has always existed between prosperity and the accumulation of metallic reserves; and, conversely, the chaos that has resulted from depletion. Of course, one may say that the possession of gold naturally indicates prosperity; but several economists and near-economists appear to argue that national success may coincide with an absence of tangible reserves.

Statistics on the mining, use and resources of gold, silver, copper, lead and zinc will always offer a good index of national prosperity.

Will a Tariff on Copper Help or Injure the United States?

A Proponent of the Proposed Protective Duty Points Out Its Advantages and Says That United States Mine Production Is Not Now Equal to Domestic Requirements

By F. W. Paine
Secretary-Treasurer Copper Range Co., Boston

TO DECIDE whether or not a tariff on copper is advisable we must first make a survey of the copper business in this country, which must include some study of the amount of copper produced and consumed. Comparing 1923 with 1913, we find consumption has doubled in this eleven-year period, while production has increased one-fifth. Production from mines in the United States was 1,228,510,000 lb. in 1913 and 1,477,824,000 lb. in 1923.

All figures for consumption are necessarily estimates. The American Bureau of Metal Statistics computes the apparent domestic consumption in 1913 at 673,783,226 lb. and at 1,328,000,000 lb. in 1923. This is after deducting from the total domestic consumption the bureau's estimate of the amount of copper exported in manufactured form in these two years.

In the first quarter of 1924 production was at the rate of 130,000,000 lb. per month, and it may decrease, owing to curtailment in output recently decided on by some Montana, Michigan, and Arizona mines. Domestic deliveries, which averaged 122,586,800 lb. per month in 1923, totaled 447,298,000 lb. in the first quarter of 1924, or at the rate of 149,099,000 lb. per month. These figures make dry reading, but there is no escape from the rather startling conclusion that *the United States is not now producing as much copper as it needs for home consumption.*

United States No Longer Europe's Chief Source of Supply

For a generation or more the United States has been Europe's main source of copper. For many years prior to 1914 American mines produced two pounds of copper for every pound required by the United States consumer. As a result of this long history of great copper exports, this country is still popularly considered to be a producer of copper far in excess of its own needs, but we must look at the present situation. There has been a complete change in the last ten years. Tracing out these changes statistically, this does not appear at first sight to be a gradual development.

The abnormal influences of the war and post-war readjustment period have obscured the record, but we are today witnessing a progressive and continuous change. The United States no longer has an exportable surplus of copper. If all the varied causes that have brought about this change continue unchecked, the alteration process will soon make us dependent on foreign countries for a large part of our own copper supply.

The following table merits careful study. The years 1914 to 1917 have been omitted, for they represent an abnormal or war conditions. In 1921 and 1922 American production was greatly restricted, because of the great surplus of copper left over from the war.

Table I—Net Exports in Terms of United States Mine Output

	Per Cent
1913	42.3
1918	8.9
1919	7.2
1920	10.9
1921	59.0
1922	20.5
1923	9.5
1924, first quarter	(a)

(a) United States consumption in excess of United States production

This table is derived from figures compiled by the government bureaus (see Table II). Here we are not dealing with estimates as to consumption, but are taking the American Bureau of Metal Statistics figures for mine production, which do not differ in any important respect from production figures reported by the U. S. Geological Survey.

Figures for imports and exports are taken from the Bureau of Foreign and Domestic Commerce. The excess exports are applied against the domestic production. In other words, if the domestic production had been less in any of the above years by the percentage indicated in Table I, there would have been no copper available for export.

Table II—Production, Imports and Exports

(In Pounds)

	United States Mine Production	Exports	Imports	Excess of Exports
1913	1,228,510,000	926,241,092	407,130,742	519,110,350
1918	1,937,374,000	747,689,580	575,805,115	171,884,465
1919	1,209,284,000	516,627,775	429,387,594	87,240,181
1920	1,270,496,000	624,053,701	485,670,691	138,383,010
1921	472,026,310	628,804,750	350,472,611	278,332,139
1922	987,707,198	743,016,507	541,013,224	202,003,283
1923	1,477,824,000	816,296,940	676,739,530	139,557,410

Exports include copper contained in insulated wire and cables and copper manufactures for the years 1922 and 1923 only. Imports include copper in manufactures for the year 1923 only.

We have still to consider the imports and exports of copper in the classification "Brass and Bronze" of the U. S. Bureau of Foreign and Domestic Commerce. For the years 1920 to 1923 the imports of brass have greatly exceeded the exports of brass and bronze. This is because of the large movement of brass scrap from the war area of Europe to American smelters and consumers.

Exports of brass and bronze in the following table include all such material which is reported in pounds. In the case of imports, scrap brass is the only item reported in pounds, so that such imports do not include manufactured brass and bronze.

Table III—Imports and Exports of Brass and Bronze

(In Pounds)

	Imports	Exports
1920	44,710,361	9,030,288
1921	40,998,549	9,391,600
1922	143,924,404	21,998,417
1923	40,790,349	31,002,474

This makes it clear that the amount of copper produced in this country did not exceed the quantity required for domestic consumption by so large an amount as the above tables would indicate. There is no escape from the conclusion that the country is now using for its own purposes, and entirely aside from copper exported in manufactured form, more copper than it is producing. When we attempt to make further refinement and go into the field of brass and bronze, instead of having this conclusion questioned it is further strengthened and the present deficit of copper for domestic requirements becomes all the larger.

The Bureau of Foreign and Domestic Commerce shows that copper imports in January and February of 1924 were 77,000,000 lb. greater than those in the same months of 1923. Exports in January and February increased 24,744,891 lb. over those of 1923, so that in two months there is a reduction of more than 50,000,000 lb. in the excess exports, which totaled 139,557,410 lb. in 1923. At this rate, in twelve months there would be 300,000,000 lb. to deduct from 139,557,410, which would mean 160,000,000 lb. of *excess imports*. Our exports may increase more rapidly from now on, but our imports are sure to increase rapidly. The record shows an ever-rising tide of imports, while exports do not show such a pronounced trend.

Imports of Primary Copper Into the United States by Quarters

(In Pounds)

	1922	1923	1924
First quarter	80,447,563	130,415,805	206,271,316 (a)
Second quarter	118,138,339	183,010,553	
Third quarter	164,857,328	187,708,530	
Fourth quarter	177,579,994	175,604,642	

(a) On the basis of January and February.

	1923	1924 (Estimated)
United States mine production	1,477,824,000	1,450,000,000
Exports	816,296,940	900,000,000
Imports	676,739,530	950,000,000
Excess exports	139,557,410	.....
Excess imports	.....	50,000,000
Per cent of United States production exported	9.5	..
Per cent of United States production imported	...	3½

I do not claim that these figures for 1924 are even shrewd guesses, but the conclusion that there will be an excess of imports is certain.

1. It is almost impossible to hazard a guess about 1924 exports. That they will not exceed 1913 in amount is a safe assumption.

2. So far this year there has been an enormous increase in imports from Chile, Peru, and Africa. Mexico shows some falling off, but all other countries show increases.

3. Domestic deliveries of primary copper were at the rate of 1,800,000,000 lb. annually in the first quarter of 1924. It seems certain that domestic consumption will be 1,500,000,000 lb. for the year. This is in excess of last year's production. No mines in this country are increasing output except two in Arizona, which recently completed new reduction plants. Many mines are reducing output. Last year's production was 1,477,824,000 lb. Local demand for more copper than can be produced in this country will stimulate imports to make up the deficiency.

The United States can obtain plenty of copper from foreign countries at 13c. per pound. At this price about one-third of our own mines can earn a profit. Why not let the producers of the remaining 66 per cent gradually give up the ghost and save 3 or 4c. a pound by buying the cheaply produced South American and African copper? About 1,000,000,000 lb. a year is now being produced by mines whose operating cost is 12 to 13c. a pound or more. This is without adding depletion to cover return of the capital. Four cents a pound on 1,000,000,000 lb. is $40,000,000 a year; a tidy sum.

Many foreign producers are glad to make capital expenditures and increase their output on a 13c. market. They have been doing this for several years and are now engaged in further expansion. Such deposits as Katanga, Chile, and Braden are young vigorous low-cost producers with large ore reserves. In this country, Utah Copper, twenty years old, is the only comparable competitor. A few others have low costs but comparatively small deposits. Utah Copper can produce but one-seventh of the minimum domestic requirements. As much more might come from a few favored Arizona mines for five or ten years. This is about as far as we need to look ahead and it is as long as we can be sure of plenty of cheap imported copper. The sum of $40,000,000 a year for five years is a saving of $200,000,000 to the United States, or about $2 per capita.

The Justice of a Copper Tariff

Entirely aside from any question of fairness to our copper producers, I believe it is clearly penny wise and pound foolish to save $200,000,000 in this way. Economists are not in agreement over the theory of tariff and protection. With controversial matters of the various schools of economic thought we are not concerned.

It is certain, however, that the tariff affects practically every phase of our economic life. It affects agriculture and manufacturing. Since 1921 Congress has protected our population by restricted immigration laws. This is good protection too. In mining we find a wide variety of articles protected by tariffs. In fact all non-ferrous metals except tin, which we cannot produce, and copper, which we formerly produced for export, are well protected by tariff. A mining industry employing a handful of men and involving two small districts in the country has a tariff of 25c. a pound. This affects us when we buy explosives, medicine, thermometers, and other articles containing mercury. Many protected mining industries are still smaller in number of men employed and value of products. There is also a tariff on lead and zinc, but the copper industry employs more men and the value of the output is greater than that of lead and zinc combined.

The Cost-of-Production Principle

Congress has chosen the cost-of-production principle in fixing tariffs. Rates are to equalize differences between costs of production in the United States and in the principal competing countries. I take it this means for copper mining that ore reserves profitable in 1913 should be profitable today. The tariff is not an institution to create a tin-mining industry in a country that has no tin ore, and neither is it a device to bolster up and keep alive marginal producers whose high-cost product is no longer needed.

Few Low-Cost Producers in United States

Too generally the question of a copper tariff has been discussed as if it were a strange device which a few marginal producers wanted so that they could continue their uneconomic—or shall we say, worthless—existence. In every copper-producing state in the Union there are vast reserves of copper-bearing ground which

were profitably worked on 13c. copper in 1913. Today they cannot be touched. Of more importance is the fact that on 13c. copper 1,000,000,000 lb. of our production cannot be sold at any profit. Michigan has none to sell at a profit unless it be a pittance from the tailing piles of Torch Lake. Montana has none to speak of. Arizona has some, but not from the Bisbee district and not from any of the southwestern porphyries, unless it be the limited high-grade tonnage of the Miami district and New Cornelia. The Verde district, ranking fifth in importance in the country, is a low-cost district. But the great majority of our production is unprofitable on 13c. copper. Why not stop talking about two-thirds of our copper production as a marginal supply? It is well enough to apply this term to that 10 per cent of the production which is most costly to make. Applying it to over half the supply is absurd.

In any mining business it is normal to find that new mines are yearly being opened, while some are closing their career. Since 1918 United States copper-mine vital statistics show no births and an abnormal number of deaths. Five years more of 13c. copper will see the United States production halved. By that time two-thirds of our supply will come from outside sources, for we will be using more copper in 1929 than in 1924.

Looking to the Future

What will be the price of copper in 1929? Cost of production in South America and Africa may be higher by that time, if for no other reason than that taxes will be some element of costs instead of a negligible factor as at present. The richest areas of the orebodies may be somewhat depleted. Labor conditions may become less favorable as time goes on, as has been the history of mining on the Rand.

When the United States production is greatly reduced the foreign producer can readily enforce his demands for high prices. If we have to have the copper we must accept the seller's terms. Thus the savings of 1924-1929, estimated at $200,000,000, will quickly be lost in the higher price for copper that we must pay after 1929 if the domestic producer be forced to the wall.

These considerations are speculative. We merely hazard the guess and judge by the situation in other commodities the domestic supply of which is inadequate. What are the losses we are sure to suffer if we save our $40,000,000? State and federal taxes amount to at least one cent per pound on the production. Lost taxes then will offset one-quarter of the four-cent "saving" as fast as the mines close down.

Indirect Aspects of a Tariff

The cost of production on this 1,000,000,000 lb., exclusive of taxes, is at least 12c. per pound, or four times the total estimated saving. This amount is paid for wages, freight, and supplies. To the working population of many important counties in many states who will suffer greatly by their loss of occupation we must add the industrial and railroad interest, a part of whose business consists in supplying fuel, steel, powder, lumber, and other materials which enter into the production of copper. If it be true that the majority of all these classes are situated in Western states, we must realize that tens of thousands of stockholders of copper-mining companies must also be given some consideration. The majority of these probably live in the East.

Why should a progressive and continuous change from a copper exporting nation to a copper importing one be allowed to continue unchecked if the varied causes responsible for this are destructive and there is a simple and thoroughly tested corrective? The causes which are bringing about this change have already forced most of the copper producers to concentrate mining on the richer portions of their orebodies, of which the supply is limited. In forcing production from such areas the greater portion of the old reserves, no longer considered minable, are usually left in such condition that their extraction in the future will be impossible.

On the present program the producer in this country is obliged to make every other consideration secondary to the matter of reduced costs of production, not because he is short-sighted, but because necessity commands it. The producer must aim for the highest possible output which he can obtain from minable reserves, and with the available labor supply. In production of any kind it is always true that a high rate of output means a low cost per unit produced. If curtailed output will increase costs even slightly, and the margin of profit has already disappeared, how can the producer reduce his output whether there is demand for the copper or not?

It is impossible to argue that the present situation makes for conservation of the country's resources of copper ore. These have always been large, and are extremely large today. But if the next five years are like the last five we find that the great majority of our known copper deposits will be in such a condition that they will be of little value to this generation or to future generations. The United States is rich enough to lose all of its copper ore reserves without feeling the loss so very keenly; at the same time these resources, considered by themselves, have always been the source of a vast amount of wealth, and should continue of large value for a long time. This particular resource has several times been of great military value, and has always been of great commercial value.

Put down on one side of the ledger the maximum figure which a tariff on copper might cost the United States. The various items on the other side foot up to a total many times larger.

Other Metals and Minerals Protected

On the general matter of protection, William S. Culbertson, vice-chairman of the U. S. Tariff Commission, in his article in the last number of "Proceedings of the Academy of Political Sciences," wrote as follows:

> "The tariff is always with us. Democrats and Republicans alike have enacted tariff laws which either incidentally or avowedly protected American industries and provided revenue for the federal treasury. No sentiment exists in the country for the abandonment of a general tariff."

There is at present a tariff on the following metals and minerals: antimony, asbestos, barytes, bismuth, cadmium, graphite, china clay, lead, lime, manganese, magnesite, marble, mica, molybdenum, pumice, potash, quicksilver, talc, tungsten, zinc, as well as on pig iron and steel ingots. Entirely apart from the business side it is hard to see any equitable or logical reason why the producers of copper should not have a tariff. The copper producers are asking for some protection: the same as is granted to other American industries large or small. Many years ago Senators and Congressmen wished to force the American copper producers to accept a tariff on copper. If such a statute had been enacted

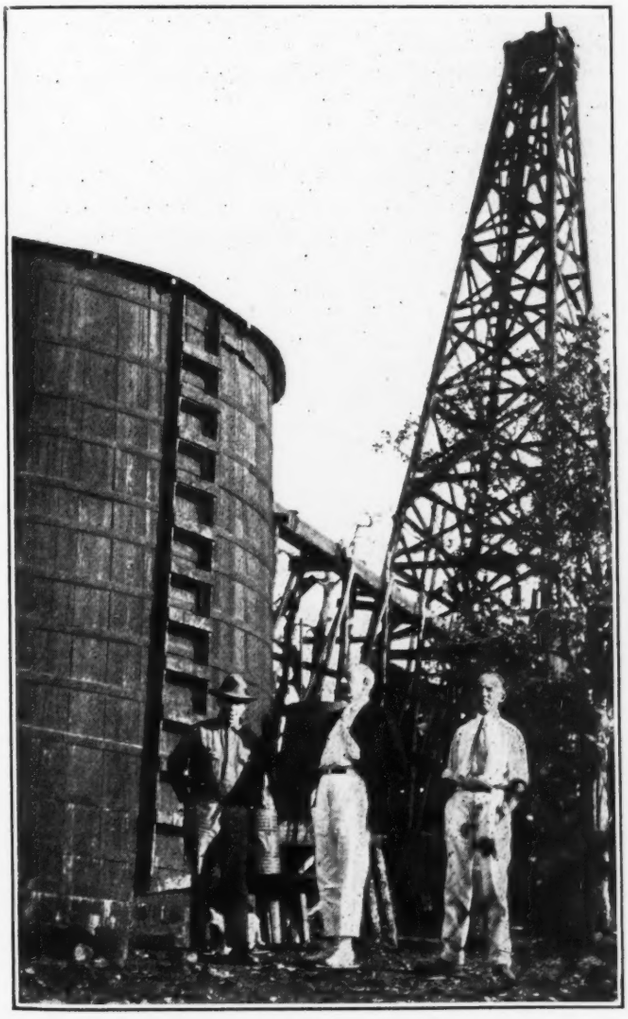
it would have been a dead letter right up to the present time. The fact that such a tariff now became effective would have attracted little attention. Similarly there is little opposition to a tariff on copper at present. Inasmuch as the copper producers request tariff protection, Congress should enact a bill providing for the placing of a reasonable duty on copper as a matter of course.

The business problem of our copper mines should be narrowed down from a world question to an affair of forty-eight states. Foreign mines now shipping copper to this country can operate in the world market and be just as well off as they are today. Perhaps a little of this copper will enter into the domestic trade after paying a duty to the federal treasury. The American producers will withdraw from export markets for a time and will devote their attention to meeting the demands of the home market. They cannot prosper when the home market is bad; but when the home market is good they are entitled to some measure of prosperity, and this, under a fair and equitable tariff, will be theirs.

Oklahoma Well Yields Liquid Asphalt

Product Brings $18.50 Per Barrel—Output Is About 65 Barrels Daily—Increase Possible

THE ONLY ASPHALT WELL in North America was discovered within the last two years in Murray County, Okla., on the top of the Arbuckle Mountains, near the village of Dougherty, on the line of the Sante Fe railroad. It is located on Scott's Dome, which rises out of the southerly slope of the Dougherty anticline and covers about 400 acres. The asphalt-producing sand was drilled into at 1,232 ft., and the asphalt flowed up and over the top of the casing, looking like thick, black tar. Earthen tanks below the well were at once constructed, and the well was put on the pump, but no working barrel or valves could carry the viscous liquid through, and the walking beam was almost pulled down in the attempt.



Rig, chute, and storage tank at asphalt well on Scott's Dome. Colonel William Scott in center

Well Fills Up During Night

A platform was then erected at a point about 20 ft. up in the rig and a chute was run from a dump on this platform to storage tanks. A bailer, moving over 50 gal. at each stroke, bails out the product of the well, about 65 bbl. per day. The liquid is drawn down by each day's bailing about 250 ft. and the next morning is back to a level about 20 ft. from the top of the hole. If some more expeditious method were discovered the production could probably be somewhat increased.

The rig has been so roofed and guttered that the great quantity of asphalt that comes out on the sand line and bailer is all caught and saved. Nevertheless, rubber heels are dragged off shoes, and soles have to be sewed on if one is to walk across that derrick floor with assurance that he will remain in possession of his footwear.

Product Used as a Preservative

The asphalt of this well is sold at $18.50 per bbl. of 55 gal. It is used largely to preserve metal against corrosion by acids or alkalies, to protect pipe lines, and by gas companies, paint manufacturers and for marine purposes. A peculiarity of this product is that while in bulk it is jet black, when held to the light the substance is opaque and, in addition, appears to be light brown in color.

Scott's Dome is capped with what is called locally Viola limestone, which is correlated by some with the Trenton limestone. At the well it is 798 ft. thick, but ordinarily is between 500 and 600 ft. Below it lies the Simpson formation, usually about 2,000 ft. thick, consisting of layers of sandstone and shale, with thin limestone partings. Under the Simpson is the Arbuckle lime, which is here estimated to be about 5,000 to 6,000 ft. thick.

Considerable difficulty was experienced in drilling this hole. The Viola lime was very hard, and in the Simpson formation much trouble was had in shutting off a heavy flow of salt water. Colonel William J. Scott undertook the drilling of the well, which is being worked by the Scott's Dome Oil Co., of Davis, Okla.

Proposed Platinum Stamping Act Legislation*

Need for Considering Effect of Proposed Law on Production

By J. M. Hill
Geologist, U. S. Geological Survey

VARIOUS ARTICLES which have appeared in the *Jewelers' Circular* and other trade papers during 1923 and 1924, relative to the enactment of a law prescribing what alloys may be stamped "Platinum," indicate that the jewelry industry is not entirely agreed as to just what should be classed as platinum. One group wishes nothing but the platinum-iridium alloy stamped "Platinum"; another wants all alloys carrying 75 per cent or more of platinum metals to be classed as platinum, and still a third would class all white alloys containing any of the platinum metals as platinum.

Why a national stamping law should be necessary to control the present practices in the sale of platinum jewelry does not appear clear. If the suggestion offered by the *Jewelers' Circular*[1], as quoted below, were incorporated as one of the requirements to be subscribed to in obtaining a state or municipal license to sell jewelry, and this license were made revocable for noncompliance with all its provisions, the solution of the present difficulties would be reached. The suggestion is:

"As we see the situation, the only way in which the buyer of platinum jewelry can fully protect himself is to demand that the manufacturer who sells him platinum jewelry disclose, first, the exact percentage of the pure platinum contained; second, the percentage of any other metals of the platinum group that it may contain, and then the percentage of gold or base metal that entered into its composition. This the buyer is entitled to and this no honest manufacturer, in view of the present situation, should have any hesitation in giving to him. . . . The retailer should know exactly what the quality of the metal is in the merchandise that he handles and knowing this should be willing to inform his customers, selling the article for exactly what it is."

Opinions of Interested Parties

Mr. Engelhard[2], of Baker & Co., Inc., has supplied valuable data to the discussion of this subject, with particular reference to its metallurgical aspects, and states the position of one of the largest refiners in the country in the following way:

"We are in favor of a law to restrict the use of by-metals to say 25 per cent, and any piece of jewelry can be called platinum if it contains at least 75 per cent platinum by-metals—whatever they are. If the percentage of platinum itself is less, then the restrictions, as indicated in the proposed law, should commence."

At a meeting of the American National Retail Jewelers' Association on Oct. 16, 1923, the following resolution was passed[3]:

"Resolved, that it is the sense of this meeting that for the protection of the public and for the best interests of the jewelry industry, there should be adopted certain definite and workable standards which shall form a basis for the stamping of platinum articles, which are as follows:

"Article I. Articles consisting of not less than 985/1000 parts pure platinum where solder is used, or 985/1000 pure platinum where solder is not used, may be marked Platinum (abbreviated 'Plat.'), and sold as platinum.

"Article II. Articles consisting of 95 per cent of the metals of the platinum group, and at least 75 per cent pure platinum, where solder is used, or 98 per cent of the metals of the platinum group and at least 78 per cent of pure platinum where solder is not used, may be sold and marked with the word 'Platinum,' immediately preceded by the name of the other chief ingredient by weight, of the platinum group, or its abbreviation, namely, Iridium-Platinum (abbreviated Irid-Plat), Palladium-Platinum (abbreviated Pall-Plat), Osmium-Platinum (abbreviated Osm-Plat), Rhodium-Platinum (abbreviated Rho-Plat), Ruthenium-Platinum (abbreviated Ruth-Plat).

"Article III. Articles containing less than 750/1000 parts of pure platinum may not be stamped with the word 'Platinum,' or any simulation or abbreviation of the name 'Platinum.'"

This proposed law seems complicated, and it appears that such long abbreviations as suggested could hardly be placed on many delicate mountings made of platinum. The simpler way would seem to regulate those that sell to the ultimate consumer by the licensing suggested before, which could be done practically by the present license forces with only small additions of personnel.

The question has been mentioned by the American Institute of Chemists[4] but apparently neither the electrical, dental, nor chemical industries have realized the bearing of this proposed legislation on their positions. All the industries using platinum should be vitally interested and should be heard before any legislation on this subject is seriously considered, either by state or federal legislatures.

The points of availability of supply and relative demand are, after all, the most important elements in such a discussion, and it is believed that the following data should be presented as widely as possible to all interested industries.

Colombia Most Active Producer at Present

As is well known, Russia was, and is potentially, the largest producer of crude platinum, Colombia, South America, ranking second, and all the rest of the world a poor third. At the present time, with Russia just beginning to come back, Colombia has attained first rank as the producer of the world's supply of crude platinum. It is equally well known that, except for a relatively small quantity of palladium and a very much smaller quantity of the other platinum by-metals recovered in copper and nickel refining, the world's supply of the platinum group metals is derived from the crude platinum produced.

To determine the relation of the world's supply of platinum to the demand of the United States alone, let us take the estimated world's production of crude platinum and analyze it as in the following tables[5]:

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*Published with the permission of the Director of the U. S. Geological Survey.

[1]Editorial "Platinum Should Be Fully Described." *Jewelers' Circular*, Vol. 86, No. 19, p. 105, June 13, 1923.

[2]Engelhard, Charles: "An Open Letter on the Subject of Platinum." *Jewelers' Circular*, Vol. 86, p. 63, June 20, 1923.

[3]*Jewelers' Circular*, Vol. 87, p. 87, Oct. 24, 1923.

[4]Wright, T. A.: "The Proposed Platinum Law vs. the Chemist and Engineer." *Jewelers' Circular*, Vol. 87, p. 73, Dec. 12, 1923.

[5]Hill, J. M.: "Some Thoughts on the Platinum Section of the Proposed National Stamping Act." *Jewelers' Circular*, Vol. 88, No. 8, p. 57, March 26, 1924.

Assumed Assay of Crude Platinum

Troy Ounces per Ton

Country	Platinum	Palladium	Iridium	Osmium	Rhodium, Ruthenium, and Other
Australia					
New South Wales..	75.9	...	1.3	....	1.3
Tasmania.....	....	...	58.1	33.5	3.0
Canada.....	72.1	0.2	1.1	....	2.8
Colombia.....	86.2	0.5	1.1	....	1.4
Japan.....	0.2	...	49.8	37.3	3.9
Papua.....	....	...	58.1	33.5	3.0
Russia.....	83.5	1.9	1.9	3.0	0.6
United States.....	85.5	0.6	1.1	1.3	1.0

Country	Production in 1921—Crude Platinum, Ounces	Calculated Content of Platinum Metals—Platinum	Palladium	Iridium	Osmium	Rhodium, Ruthenium, and Other	Total
Australia							
New South Wales...	249	189	...	3	.....	3	195
Tasmania.....	1,751	.....	...	1,017	587	53	1,657
Canada.....	15	11	...	.....	.....	...	11
Colombia.....	35,000	30,170	175	385	.....	490	31,220
Japan.....	255	1	...	127	.....	8	136
Papua.....	360	.....	...	209	121	1	331
Russia.....	20,000	16,700	380	380	600	120	18,180
United States.....	977	835	6	11	13	10	875
Totals.....	58,607	47,906	561	2,132	1,321	685	52,605

Evidently 62,600 oz. of the platinum group metals, all that the world produced in 1922, is inadequate to supply the world's demand for these metals, for in 1921 the demand in the United States alone amounted to 176,148 oz.

Chief Platinum Metals Consumed in the United States as Reported by Refiners in 1921, by Industries

In Troy Ounces

Industry	Platinum	Iridium	Palladium	Total	Percentage of Total
Chemical.....	12,273	34	45	12,352	7.01
Electrical.....	20,574	1,003	7,626	29,203	16.58
Dental.....	13,181	75	8,501	21,757	12.35
Jewelry.....	101,258	2,367	1,265	104,890	59.55
Miscellaneous.....	3,791	3,938	217	7,946	4.51
Totals.....	151,077	7,417	17,654	176,148	100.00

Platinum Metals Recovered by Refiners in the United States in 1921, by Sources

In Troy Ounces

Source	Platinum	Palladium	Iridium	Osmiridium	Other	Total
New Metals						
Domestic						
Crude.....	580	3	99	119	12	813
Ore.....	1	192	.....	...	.....	493
Gold and copper refining.....	2,318	1,165	11	...	.....	3,494
	2,899	1,660	110	119	12	4,800
Foreign						
Crude.....	46,973	302	110	462	758	48,605
Gold and copper refining.....	1,919	724	66	...	256	2,965
	48,892	1,026	176	462	1,014	51,570
Total recovery, new.....	51,791	2,686	286	581	1,026	56,370
Secondary metals....	39,131	4,887	1,776	...	.....	45,794
Grand total.....	90,922	7,573	2,062	581	1,026	102,164

It will be seen by a study of the tables that the supply of iridium, osmium, rhodium, and ruthenium is much under the minimum demand of the United States.

The question that should have careful consideration by all industries using the platinum metals, and particularly the jewelers, who advocate the 5-10 per cent irido-platinum standard, is this: What effect will such a law have on the supply of the metals? Apparently platinum and palladium will not be affected materially, for the supplies of these metals are relatively large. But what of the other metals of the platinum group, whose supply is so short?

The jewelers are the large steady consumers of platinum metals, and their demand is the one that keeps the platinum-refining industry alive. The next largest consumer is the electrical industry, whose yearly demand is for about 25,000 to 30,000 oz. of platinum metals, of which platinum and iridium form the bulk. The dental industry is the third largest consumer, and its demand is largely for platinum and palladium. The demand for the chemical industry is small and is very largely for platinum. The miscellaneous uses are for photography, largely platinum, and pointing gold pens, for which the native or artificial iridium-osmium alloy, known as osmiridium, is used entirely, and it must be remembered that it is from the natural alloy that the world gets its iridium.

Bearing the facts presented in mind, it is apparent that hastily conceived legislation will result, first, in a violent upward trend of prices of the less abundant platinum metals; that the second reaction will be a wild scramble for new deposits, which will yield iridium; and that the third will be a gradual settling down to the realization that the world's supply of these metals is strictly limited and that the value of all the metals of this group, as a consequence, will always remain high. The consumers of jewelry can and will pay for the higher priced alloys. The other consuming industries, however, are not in that happy state of having a customer with an unlimited purse.

Loose Talk in High Places

In a pamphlet issued to stimulate the demand for U. S. Treasury savings certificates, says *The Wall Street Journal* editorially, a phrase is used to which strong exception must be taken: "A mine is a hole where fools dump their money." It is entirely proper to warn the untaught investor against fraudulent propositions, whether mineral or otherwise, but the officers of the Treasury should not permit this sort of loose talk.

A mine is not a hole in which fools dump their money. It is a hole from which an enormous part of the raw materials of the greatest manufacturing country in the world has been taken. It is a hole from which a great part of American wealth has been taken and a still greater part of this country's potential wealth must be taken and will be taken in the future. A mine is an entirely proper investment. The circular says: "There are good mining and oil investments, but how can we tell the good from the bad?"

When the United States Treasury collects a corporation tax it has no difficulty in telling the good from the bad. The way for the investor to tell the good from the bad is to satisfy himself of the character of the men with whom he will be associated. Doheny took his fortune out of the new wealth he created and not out of the pockets of swindled investors. Those who followed him found they were in good company. The Standard Oil stocks were offered for public subscription, and the people who had faith in that promotion grew rich. Some of the ablest and cleanest men in American business are on the boards of mining companies.

The phrases quoted are claptrap. The Texas oil swindles were not mines at all, but the merest prospects. Washington might have done something to protect the victims by a better scrutiny of the mails. Is it even wise after the event? We have a similar experience in New York. Swindling bucket shops flourish. . . Secretary Mellon and Assistant Secretary Eliot Wadsworth have done wonders, but they cannot be in several different places at once.

It would seem as if some Treasury literature needed an editor. That department is certainly not in the business of throwing an unwarrantable aspersion on the character of one of our greatest industries.

Notes on Rio Tinto's Operations

By Arthur L. Walker
Professor of Metallurgy, Columbia University

A. L. Walker

DURING a trip around the world last year, I was extremely fortunate in being able to visit the Rio Tinto mines, in the southwestern corner of Spain. Armed with a strong letter of introduction to be presented at the junction station where the railroad operated by the Rio Tinto Co. leaves the main line from Seville to Huelba, I was able to pass the picturesque mine guards who, satisfied that my credentials were in proper form, were most helpful in every way.

The Rio Tinto mines are probably the most interesting in the world, especially from a historical standpoint. In ancient times they were worked extensively by the Romans, the Phoenicians before them, and probably the Iberians before the Phoenicians.

Bearing on the history of the mine, the highly interesting photographs reproduced on pages 803 and 804, indicating the extensive amount of early work performed by the ancients, were presented to me by Mr. Gorden Douglas, assistant general manager, to whom I am greatly indebted.

After the Roman period little work was done at these mines until the beginning of the eighteenth century, when they were operated by a system of leasing. In 1873 they were bought by an English syndicate from the Spanish Government for approximately twenty million dollars, and since that time work has been actively prosecuted, with excellent results. Prior to 1900, a large portion of the mining work was open cut and little underground work was done. Now, however, the amount of underground work is increasing.

The ore mined is now treated by two methods: (a) smelting and (b) leaching and direct precipitation on iron. About one-half of the ore is smelted in ordinary water-jacketed blast furnaces, with a very small percentage of coke and utilizing the sulphur in the charge to generate much of the heat required. A copper matte is produced in one operation which can be treated direct in a basic-lined converter. The novel feature in the smelting operation is the use of so little coke that practically pyritic smelting is carried on, and the very low lime content of the slag.[1]

The process by which the other half of the ore is now treated is highly interesting. The ore as it comes from the mine is delivered by cars to large piles or heaps, containing upward of 600,000 tons each. These heaps are placed on sloping ground so that when the top is level the lower edge will be about thirty feet high, while at the upper part the ore may be only one or two feet deep. The lower layer of ore is composed of boulders, so that it is extremely porous, and at intervals chimneys of large pieces are sometimes built in the pile so as to form draft channels. The process is one of oxidation and leaching, but the ore pile is never immersed in water. In fact, at the beginning no water is added. The moisture from the ground, on which the ore is piled, rises into the pile, and, with the access of air, oxidation begins sometimes so rapidly that the heat generated is excessive. The heat is controlled by spreading fine ore over the top of the pile to regulate ventilation and cut off the draft from points which have become unduly hot.

After a certain amount of oxidation has taken place, water, or, more often, spent solution from a preceding operation, is allowed to flow over the surface of the ore, the flow of water being regulated by dividing the surface of the pile into a series of comparatively small basins formed by making ridges with the fine ore on top. The entire pile is never flooded at the same time, the water being delivered first to one set of these basins, and afterward to another set. The pyrite is acted upon very slowly; in fact, only a small portion of the pyrite is affected at all—most of it after a period of years being recovered unaltered from the pile. What pyrite is affected will produce ferrous sulphate and sulphuric acid. The ferrous sulphate is oxidized to ferric sulphate, which is the solvent used in leaching, as shown by the following chemical reactions:[2]

$$Fe_2(SO_4)_3 + Cu_2S = CuSO_4 + 2FeSO_4 + CuS$$

$$Fe_2(SO_4)_3 + CuS + 3O + H_2O = CuSO_4 + 2FeSO_4 + H_2SO_4$$

The cuprous sulphide is acted upon quite rapidly, whereas the cupric sulphide requires a long time even under the most favorable conditions. As a matter of fact, to obtain satisfactory recovery of the copper, many years are required and the ore is tied up in heaps for periods of from three to fourteen years. Even then, after reclaiming, some of the ore is returned to the piles for second treatment. The total recovery of copper by this system is said to be about 95 per cent.

The solution from the leaching piles, when it contains a sufficient amount of copper, is led to the precipitating launders or tanks, where the copper is precipitated on pig iron or scrap. Since the war a large amount of scrap iron has been used, as it has been readily obtainable. The copper which has been precipitated on the iron is removed at regular intervals, dried, screened, and divided into two classes. The first class, or high-grade cement copper, is shipped; the second class, or low-grade, is made into briquets and smelted in the blast furnaces.

The descriptions given above are very general, for, while the officers of the company were kind enough to furnish details, I did not ask permission to publish them and would not like to do so without consultation.

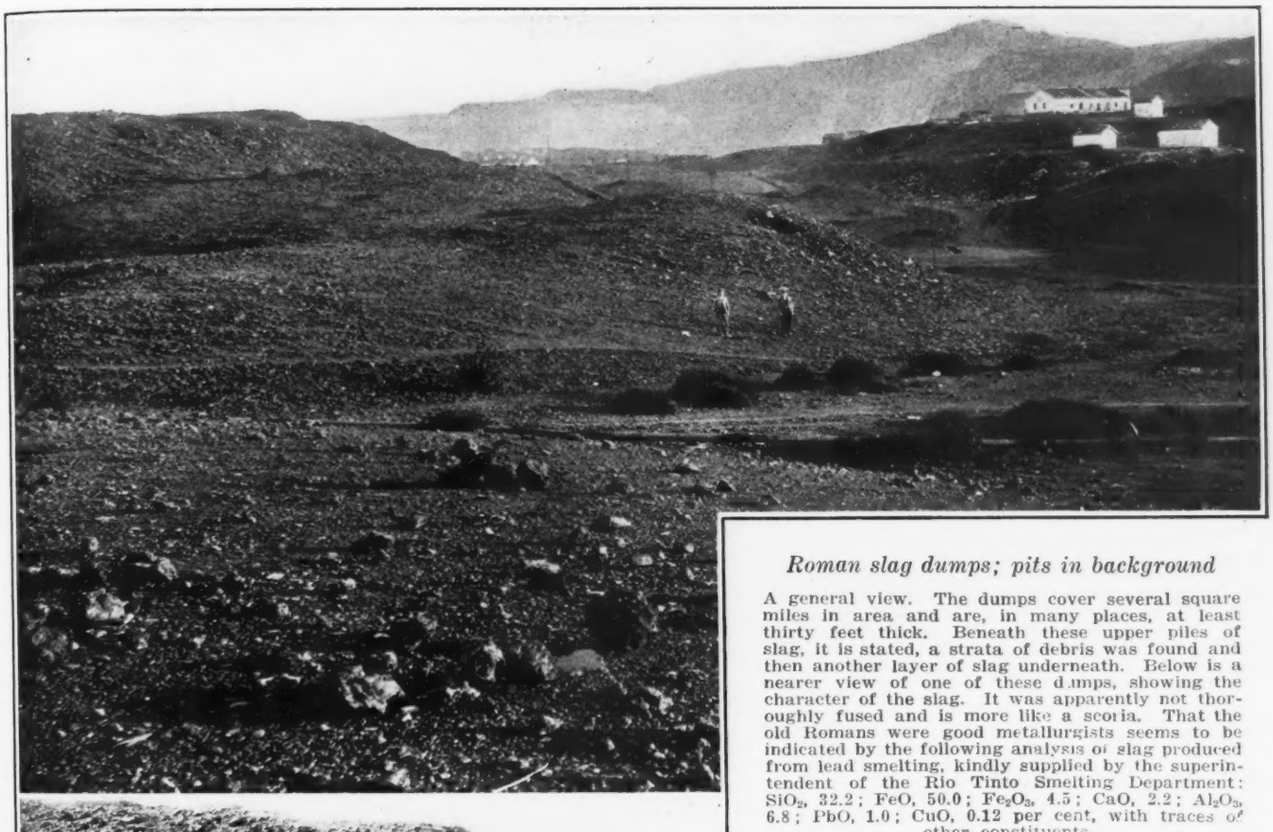
One thing that interested me greatly was the admirable welfare work conducted by the company.

My visit was most interesting and instructive and the extreme courtesy shown me was greatly appreciated.

[1]The metallurgical operation has been ably presented in an article, by Courtenay De Kalb, entitled "Metallurgical Methods at Rio Tinto," *Mining and Scientific Press*, Feb. 5, 1921.

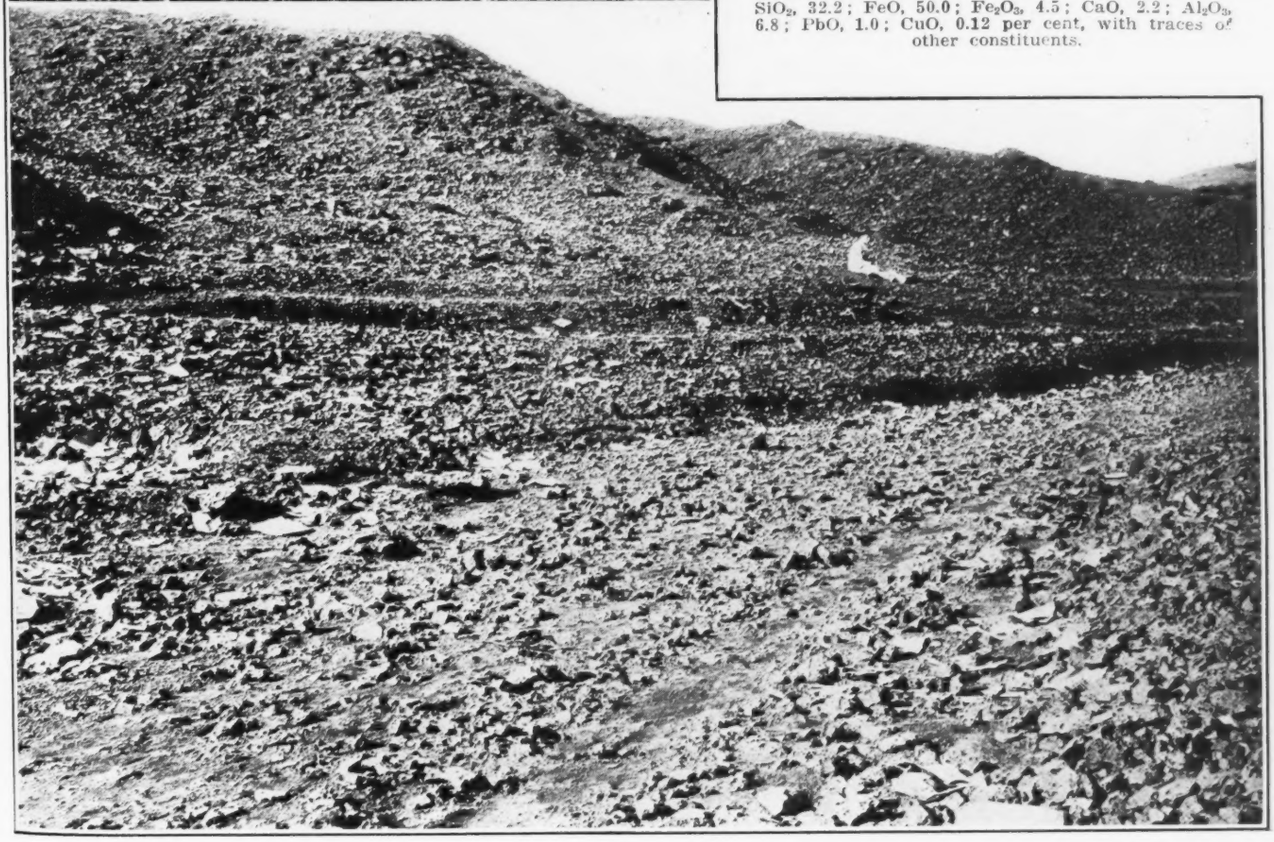
[2]See article, "Wet Methods of Extracting Copper at Rio Tinto, Spain," by Charles H. Jones, *Transactions* A.I.M.E., Vol. 35, p. 3.

Ancient and Modern Mining at Rio Tinto



Roman slag dumps; pits in background

A general view. The dumps cover several square miles in area and are, in many places, at least thirty feet thick. Beneath these upper piles of slag, it is stated, a strata of debris was found and then another layer of slag underneath. Below is a nearer view of one of these dumps, showing the character of the slag. It was apparently not thoroughly fused and is more like a scoria. That the old Romans were good metallurgists seems to be indicated by the following analysis of slag produced from lead smelting, kindly supplied by the superintendent of the Rio Tinto Smelting Department: SiO_2, 32.2; FeO, 50.0; Fe_2O_3, 4.5; CaO, 2.2; Al_2O_3, 6.8; PbO, 1.0; CuO, 0.12 per cent, with traces of other constituents.

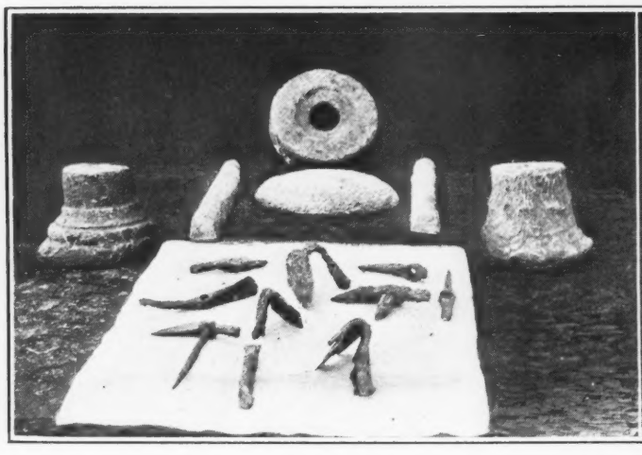


An old Roman shaft exposed by steam-shovel workings in the Rio Tinto open cuts

It is about 4 x 4 ft. in cross section and distinctly shows the niches by means of which the ancient miners climbed out carrying the ore on their backs.

An old timbered Roman shaft used by the earliest miners

The miners used a crude method of cribbing with pointed sticks set so as to permit lagging when required. Some of the old workings are believed to date back 3,000 years.

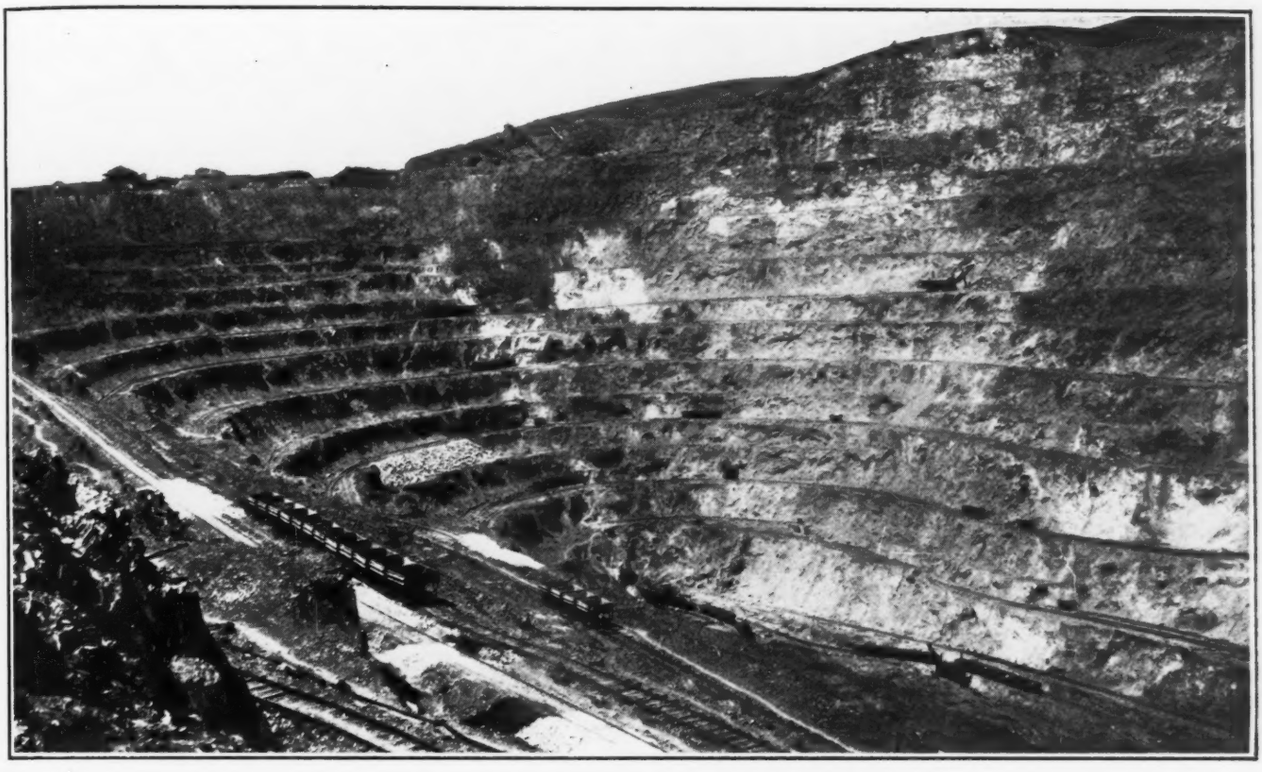


Roman tools unearthed by Rio Tinto Co. and samples of metallurgical work

The forerunners of modern mining implements. The bars in the background are pig lead produced by the first metallurgists. The bases of the columns shown are evidently remains from Roman residences. The tools used are not much different from some employed in mining of the present.

Roman burial equipment recovered by mining—all of it well preserved

This includes eating and drinking utensils and a tear glass—the long slender object—in which mourners showed their sympathy. The slabs are the sides of the box in which the equipment was placed. To the left is a jar—an amphora—for holding wine; to the right a receptacle for provisions.



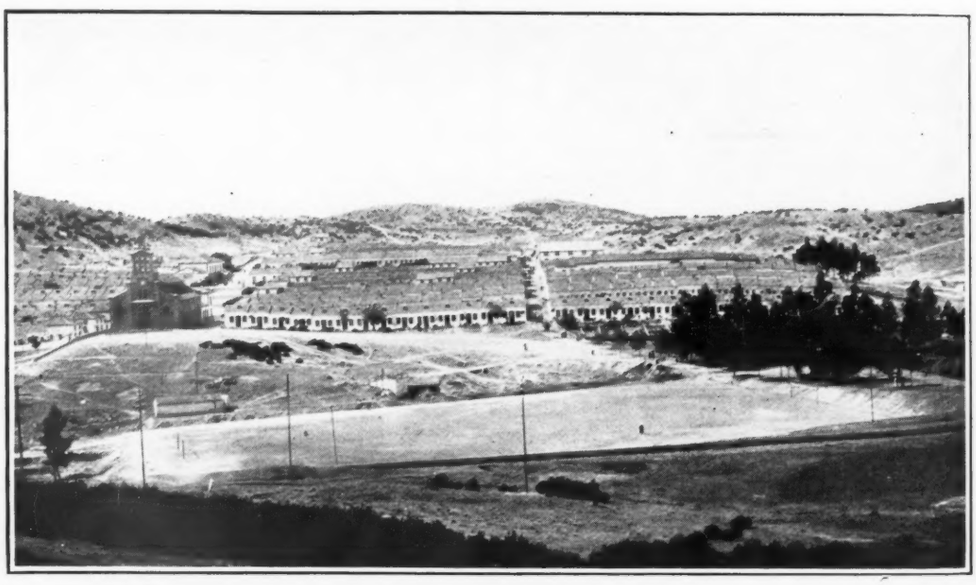
Main open cuts of the Rio Tinto mines

A few more open cuts are situated on the far side and to the left of the one shown in these two photographs. All of them are tapped by tunnels which have direct connection with the main railroad tunnel about 5 km. long whose portal can be seen in the lower view. Although up to the present a large percentage of ore was extracted by open cut steam shovel operations, the amount obtained by underground mining is increasing.

The orebodies occur as mammoth lenses between slate and porphyry and are capped by masses of iron-bearing gossan. The principal mineral in the ore is cupriferous pyrite. Three grades of ore are produced: (1) smelting ore carrying 4 to 6 per cent copper; (2) export ore with about 3.5 per cent copper and 40 to 50 per cent sulphur; (3) leaching ore containing 1.5 to 2 per cent copper.

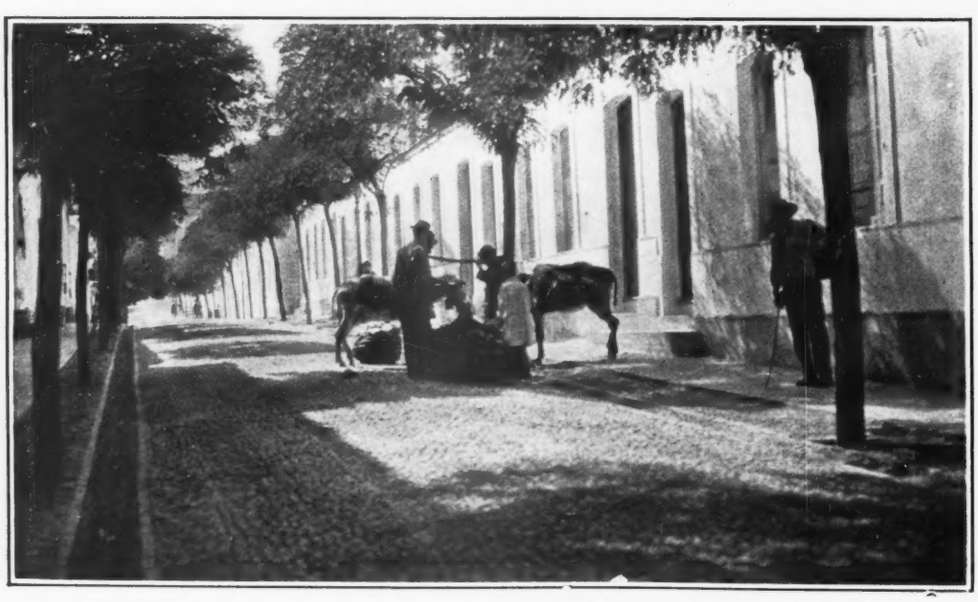
The old Rio Tinto village

It stands on the edge of a large open cut. Part of it was undermined and caved about fifteen years ago. All of the extensive area shown is served by an admirable railroad system. Considerably over 100 miles of track are in service.



One of the seven villages at Rio Tinto

Each one has its own church, athletic field, and neatly laid-out streets and miners' homes surrounded by trees. The English settlement, Buena Vista, not shown, is laid out on an elaborate and beautiful scale. The native boys have become quite expert football players under English tutelage.



A street in a village

Note its cleanly and well-paved appearance. Peddlers carry provisions to the doors of the employees' homes.

The Bogey of Cheap South American Copper

Low Operating Costs Neglect to Take Into Consideration Immense Investments That Are Involved

By Arthur Notman
Consulting Mining Engineer and Geologist, New York

THE RECENT AGITATION for a tariff on copper is apparently based on the assumption that copper can be produced in South America and Africa so cheaply that it will drive many of the mines of this country out of business. Despite an unprecedented domestic consumption, it is argued that domestic producers are operating on a curtailed scale at low prices owing to the influx of foreign copper, and it is felt that the United States is shifting from a country which exports to one which imports copper. If the above assumption is founded on facts, and the shift is permanent, no doubt the high-cost producers in this country will be driven to the wall.

Before considering the basis of the assumption, let us examine the question of the tremendous increase in domestic consumption. Nearly all authorities agree that the following factors have contributed to this result: first, the rapid expansion of the electrical industry; second, the closely related and equally rapid expansion of the communications industry (telephone, telegraph, cable, and wireless); third, the phenomenal growth of the automobile industry; and fourth, the shortage of building facilities accumulated during the war. Authorities seem to differ somewhat on the remaining shortage in the last-named industry, or whether much of it can be satisfied at present costs.

Many prophets have predicted a rapidly approaching saturation point for the automobile industry. As more than 80 per cent of the automobiles in the world are owned in the United States, there would appear to be ample room for further expansion, providing our manufacturers can compete in world markets. A tariff on any of the raw materials consumed, unless offset by "drawbacks" for export, certainly will not assist them to compete.

When we come to the electrical industry proper, there are certain extraordinary conditions which require consideration before we can be sure of the facts. It seems logical to suppose that much of the world's demand, formerly supplied by the great electrical manufacturing plants in Germany, has had to come to America for its satisfaction. Whether it will continue to do so, after Europe goes back to work, will depend on the competitive power of the American manufacturers. That they could successfully carry the added burden of a tariff on their raw materials is open to question.

Of course, any discussion of relative imports and exports of copper to and from the United States, if it deals merely with copper in unmanufactured forms, is quite beside the point in determining the volume of the metal which finally lands in the hands of the ultimate consumer here and abroad. The correct basis for weighing this major premise of the protagonists of a tariff on copper was clearly pointed out in these pages in the issue of April 26, 1924, by the Editor, in his reply to the letter of E. G. Wentworth. Dr. Spurr cites the figures of the U. S. Department of Commerce which show that the excess of exports over imports of copper in all forms for 1922 and 1923 was 108 and 145 million pounds, respectively. As he states, even these figures are incomplete in that they do not include the amounts contained in the "electrical machinery, automobiles, chemicals, ships, railway equipment, ammunition, and in other articles of minor importance."

If we approach the subject from the point of view of the country at large, we discover that the security of the nation in time of war, for many years to come at least, will depend in large measure on the available domestic supply of copper. If for the present we can consume South American and African copper cheaper than our own, why not continue to do so, particularly when in so doing we will indirectly accelerate the payment of the huge credit balances abroad, which the war unexpectedly brought us?

It is only natural that some domestic copper producers, confronted with costs 20 to 30 per cent higher than the pre-war level, and a selling price below the pre-war level, should take fright at "unofficial" statements of copper from South America being landed on the market in New York for 7½ to 8c. per pound. But how well do the official records of the South American producers up to date support these "unofficial" statements?

Before examining the evidence, there are one or two definitions which it will be well to clarify, so far as possible. What do we mean by profits, depreciation, and depletion in the mining industry? We must never forget that dividends from mining companies are never wholly profit, but represent both return of capital and interest and profit. The proper allocation of dividends to these three sources is determined by four factors: First, the amount of capital required to find an orebody, acquire title, and to explore, develop, and equip the property to deliver a certain predetermined volume of merchantable product on the market; second, the length of time required for this purpose, and consequent loss of interest on the capital so employed, and the deferment of profits; third, the operating profit on extracting and delivering the product to the market; and fourth, the length of time required to exhaust the mine.

Discussion of "Depreciation" and "Depletion"

The two terms designed to cover the functions of capital in these various activities, aside from financing current production, are "Depreciation" and "Depletion." Perhaps no terms in the whole glossary of engineering and accounting are more often subject to serious misapprehension. So important, however, are they to the successful direction of industry that I do not hesitate to devote considerable space to their discussion. A rather extended search of the literature of the mining industry has failed to disclose any clearer description and definition of these functions of capital than that presented by J. R. Finlay in his "Report of Appraisal

of Mining Properties of New Mexico" to the Tax Commission of that state in January, 1922. The example used is that of a young man who purchases an automobile with borrowed money to be driven by himself in passenger service for hire. It deals clearly with the interest and amortization of the loan, or depletion, and the maintenance and depreciation of the equipment, with resulting profit or loss on the operation. Finlay says in part:

"There is some reason to apprehend that many persons imagine depletion and depreciation to be mere phrases that serve some mysterious purposes in the minds of accountants (mysterious persons anyway) but have nothing to do with real money. So far is this from the truth that it is not too much to say that any man who does not have a clear idea of what those terms represent in hard actualities is carrying on his business in the dark and will be lucky indeed if he escapes a fall.

"Depletion and depreciation are, however, both calculated figures based on the average experience of business. Their purpose is to show the producer what price he must receive for his product just to break even; that is, theoretically, to retain his capital intact but gain no profit. This is the line between gaining and losing; if the business is losing, it is obviously necessary to do something to remedy it.

"We may illustrate all this very clearly by considering the purchase, use, and life of automobiles and the life of the men who run them. Let us suppose that the machines are to be run for business."

He then follows the young man through his negotiations with the banker for the loan, and the annual interest and principal payments to be made, and the reasons governing the term of the loan, or depletion. Then comes a discussion of the maintenance of equipment, followed by the realization that he must every so often replace his machine with a later model or be in danger of losing his entire trade to his rivals. Finally these factors are reduced to costs to determine how much the young man must charge to meet all these costs as well as those of operating and still make a profit. To resume in Finlay's words:

"If he just meets these figures he has no profit, for they merely represent what he would have had if he were not in the business at all, undertook no responsibility, and worked for somebody else at the wages anybody might get. His profit is what he may get over 21 cents per mile; his loss is the amount under that figure.

"At the end of twenty years, however, he will owe nobody a cent and he will have a new car. If he is still able to continue in business he will be able thereafter to carry passengers 1 cent per mile cheaper. If he can still get the same prices his profit will be $96 a year greater.

"But if at the end of twenty years he is no longer able to drive the car and nobody else can drive it, neither he nor anybody else will get any benefit from it and he might just as well not have it.

"Here we reach apparently a fault in our logic, because a new automobile is obviously worth the price it can be bought or sold for at the moment the transaction is made.

"But when we change all this to represent mining there would be no fault in the logic at all. If instead of our adventurer we substitute a mine, if instead of the exhaustion of his personal energy we substitute the exhaustion of the ore or coal supply, if for the automobile we substitute the plant and equipment, we run straight upon the difference between mining and transportation. The automobile would be an asset; the mining plant would not be; it would be absolutely worthless, no matter how well it had been kept up to the very last day. Therefore in mining the amortization of capital does not add any gain; it does not change the ownership of a resource which has perpetual value; it merely keeps the original capital intact. Similarly, the depreciation, instead of restoring a plant that may be used indefinitely, just applies to the period of use and has no value except to maintain efficiency during that period.

"If, however, our adventurer should remain in business for thirty or forty years instead of twenty, he would, after the amortization of his debt in twenty years, enjoy additional income, and the installments he had paid would represent capital which he had acquired for himself, the value of which would be a function of the number of years of use he would have of it. Similarly a mine which proves to have a longer life than that for which the amortization, or depletion, is calculated, also accumulates value thereafter as long as the property remains active.

"This I think is the only difference between the finance of mining and that of a self-perpetuating business."

Before the federal income and excess profits taxes were levied, it was generally customary for stockholders in metal-mining companies in this country to make their own allocation of the dividends received to return of capital, interest, and profit. It frequently happened that the introduction of improved methods brought these companies face to face with the fact that although their plants were as good of their kind as any in the business, they could not hope to maintain their proportion of profitable business unless they had the latest improvements, which their competitors had installed. Dividends had to cease, and in extreme cases additional capital had to be provided.

The fallacy of this point of view was discovered long ago in the iron and steel industry. It is generally considered necessary for the steel companies to be prepared to scrap their entire plants at least once in fifteen years. The resulting financial burden becomes immediately evident when we learn that to establish an output of 1,000,000 tons of steel per annum today in the United States requires an investment of 150 to 200 million dollars. It was undoubtedly the recognition of these factors that has dictated the sound conservative dividend policy of the United States Steel Corporation and its "sowing back" of operating profits into the business.

With the advent of the "porphyry coppers" parallel development has taken place in the copper industry, but evidence is not lacking that here the lesson has not yet been thoroughly learned.

Copper Mining No Longer a Poor-man's Job

Today to establish a copper production of 100,000,000 lb. per annum in the United States usually means an investment of from thirty to forty million dollars; and a similar venture in South America, with the added facilities for transportation, power, housing of employees, and other accessories, which inevitably must be supplied by those undertaking the investment, will require about two times this amount. Only deposits of indefinite life warrant such investments, and the problem of returning such large amounts of capital with interest and profit, and at the same time retaining sufficient cash on hand to make improvements in plants and processes as they are developed, and thus maintain their ability to meet strenuous competition, requires the highest degree of intelligence and financial wisdom.

With an assured life of thirty years or more, the cost of amortization of capital and interest, which we call depletion, becomes a simple question of arithmetic. As such we may dismiss it from further consideration at the moment. On the other hand, the cost of maintaining the productive capacity of the property on the same level of volume and efficiency as originally established to meet competition, which we call depreciation, can be determined only by experience. Sound evidence that is available, however, supports the belief that this cost per pound of copper produced in the United States during the last ten years varied

from 1 to 2c., with 1½c. about the average. There are equally strong reasons, as yet not so thoroughly established, for believing that this cost in South America is from two to three times greater.

This brings us to the object of our investigations, the official records of the South American copper companies. Here I should like to refer to my article which appeared in the June 30, 1923, issue of the *Engineering and Mining Journal-Press*, showing the comparative earning power of capital invested in the copper industry of the Western Hemisphere. By reference to that article, it will be seen that the "dividend cost," or the selling price less the dividends paid per pound, in the last period, from 1916 to 1921 inclusive, was approximately 16.5c. for the North American group, against 21.5c. for the South American group.

If to the dividends paid by the South American group we add the approximate amount of the bond interest, sinking fund installments, bond discounts, and interest on floating debts, $27,200,000, the total amount of their earnings would be increased to about $46,000,000, or, say, 3.9c. per pound. The amounts of these various payments were as follows: Cerro de Pasco, $5,133,950; Braden, $7,561,145, and Chile, $14,511,558. Of the North American group, the Anaconda Copper Mining Co. was the only one with any bonded indebtedness during this period. The amount of interest paid by Anaconda on this indebtedness during these six years was $7,930,466. This would increase the earnings per pound for the group to 6.8c. or 74 per cent more than the South American group for the same period. On the same basis, the costs, after taxes, other charges, and depreciation, but before bond interest and depletion, would appear as follows: South America, 19.5c., and North America, 16.4c. Obviously, there is nothing here to support "unofficial" claims of South American superiority. The difference in the method of financing in the two continents is in itself quite significant of the difference in the degree of speculation in the ventures.

Costs According to 1923 Figures

To bring the question up to date, I have made a comparison of the results obtained in 1923, as shown by the official reports, just issued, of the same South American group, with a similar group of North American companies, namely: Nevada Consolidated, Miami Copper, and Utah Copper. The unit of comparison chosen is the earnings per pound produced available for dividends, after all charges for operating, sales, taxes, interest, other charges, and depreciation have been met, and all miscellaneous income has been credited, but before any charge for depletion. This is essentially the same unit used in the previous article referred to above.

Cost and Earnings for 1923 of the North American Group

Company	Production, Pounds	Earnings Before Depreciation	Depreciation	Earnings Available for Dividends Amount	Earnings Available for Dividends Cents per Lb.
Nevada Cons.	61,573,246	$2,620,798	$526,120	$2,094,678	3.40
Miami Copper	64,611,145	2,807,673	405,300	2,402,373	3.72
Utah Copper	195,142,919	12,140,263	1,667,465	10,472,798	5.37
Totals	321,327,310	$17,568,734	$2,598,885	$14,969,849	4.66

Earnings for 1923 of the South American Group

Cerro de Pasco	105,000,000	$8,971,200	$2,271,031	$6,700,169	6.38
Braden Copper	139,530,000	7,043,891	2,111,086	4,932,805	3.54
Chile Copper	204,897,590	15,026,680	2,116,053	12,910,627	6.30
Totals	449,427,590	$31,041,771	$6,498,170	$24,543,601	5.46

Contrary to the custom of all the other companies, the Cerro de Pasco gives no production figures in its annual report to stockholders. Consequently I have been obliged to estimate the production from the U. S. Department of Commerce figures on imports from Peru, and various statements in the technical press on the capacity of the company's new smelter. On this basis, the report shows that the gold and silver credit amounted to over $5,500,000, or 5.5c. per pound of copper produced.

On the face of these returns, it appears that South America has outstripped a group of leaders of the North American industry. But before entering final judgment in their favor, we must examine the question of capital cost in the two countries.

To compare the amounts of capital invested in the two groups, I have taken the figures from the asset side of their balance sheets, less their depreciation reserves, but before depletion. In the case of the Miami Copper, whose revaluation surplus as of March 1, 1913, is included in the item of mining property, I have deducted the depletion reserve set up on that company's books, to put all the companies on the same basis.

Table Showing Capital Return

Company	Production, Pounds	Total Assets Less Depreciation	Per Lb. of Annual Capacity in Cents
Nevada Consolidated	61,573,246	$29,150,320	45
Miami Copper	64,611,645	20,631,450	32
Utah Copper	195,142,919	71,839,958	36
Total	321,327,810	$121,621,728	38
Cerro de Pasco	105,000,000	44,866,879	43
Braden Copper	139,530,000	47,864,934	34
Chile Copper	204,897,590	156,980,261	77
Total	449,427,590	$249,712,074	56

To justify the values shown on the balance sheets, annual dividends to the stockholders must be large enough to yield the going rate of interest, say 5 per cent, and additional installments which if reinvested at 4 per cent will return the principal amount at exhaustion of the ore deposits. Dividends received by the investor at these valuations in excess of the amounts to be provided above constitute his only real profit. Failing in such additional return, he might better have had his money in sound 5 per cent bonds, with none of the hazards of a mining investment.

Both of the groups have combined ore reserves of practically indefinite life. Still, to anticipate the revolutionary changes which history shows have occurred at intervals in the past in the technique of the industry, and which have resulted in substantial realignment of competition, we cannot safely postpone the final return of the capital and interest beyond a period of twenty years, and then only if we have charged sufficient to depreciation to offset the continual tendency of capital investment in plant and equipment to increase.

These considerations lead us to the conclusion that after all charges excepting depletion have been met and miscellaneous income has been credited there must be a return of 8 per cent annually on the capital investment. Such a return will amount to 3c. per pound for the North American group, and 4.5c. for the South American. In the latter case, if we include the premium of $10 per share above par paid by the Anaconda company on the 2,200,000 shares of Chile Copper purchased, we shall increase the invested capital by $22,000,000 over the amounts above taken from the annual reports, thereby increasing the required return to 4.8c. per pound.

Applying these charges to the 1923 earnings, before depletion, we find the following:

Earnings, Costs, and Profits in 1923

	Earnings per Lb. Available for Dividends (Before Depletion) Cents	Capital Cost per Lb. (Depletion) Cents	Profit per Lb. Cents
North American group	4.7	3.0	1.7
South American group	5.5	4.5	1.0
		4.8	0.7

NOTE—The lower line of figures includes the Anaconda bond charges.

From a practical standpoint, the investor must determine the capital cost from the market value of the securities at the time he purchases and not from the book value of the assets shown on the balance sheets. His choice of stocks should be guided by this factor, as well as the life of the known reserves, their possible extensions, the cost of producing, and the rate of production.

AMOUNT OF WORKING CAPITAL REQUIRED

The history of the industry has shown conclusively that the amount of net current assets, or working capital, required to finance production comfortably and avoid the costly contingency of working with borrowed money, should equal the total cost of nine months' to one year's production to the final form in which the particular unit of the industry delivers to its customers. Failure to maintain such an amount through over-expansion without additional financing, or the overpayment of dividends, will inevitably result in loss of earning power.

On Jan. 1, 1924, the net current assets, or working capital, of the two groups was as follows:

Working Capital Jan. 1, 1924

	Amount	Cents per Lb. of Annual Capacity
North American group	$30,440,687	9.5
South American group	38,176,592	8.5

Here again we find no superiority south of the equator.

Finally, the following group of North American companies produced during 1923, 633,300,000 lb., on which they showed earnings available for dividends of 3.3c. per pound: Calumet & Arizona, Chino, Inspiration, Miami, Nevada, New Cornelia, Old Dominion, Ray, and Utah. Their output constituted approximately 50 per cent of the domestic production. It is safe to assume that the average capital cost of the whole group would be substantially the same as for the three considered in detail, or 3c. per pound, leaving a margin of profit of 0.3c. per pound, compared with 0.7c. for the South American properties.

These results for the year as set forth officially in the annual reports of the various companies merely serve to confirm those disclosed in the previous official history of their operations. It is true that the South American companies have shown a relatively great improvement, but only at the expenditure of fifteen years of effort and double the amount of capital required by the domestic companies. As yet, Cerro de Pasco alone has made real progress in repaying the capital and effort, owing very largely to the high gold and silver content of the orebodies which it has so successfully worked.

Chile, after producing over 800,000,000 lb. of copper, has finally entered the lists of dividend payers. Under normal market conditions, this production would have yielded to the average domestic producer $32,000,000 in dividends to its stockholders.

Braden, after producing 641,000,000 lb. of copper, is still working to repay a floating debt of $11,500,000 to the holding company, the Kennecott Copper Corporation, with the prospect that it will be at least another two years before it can safely join the ranks of the dividend payers. By that time it will have turned out a grand total of over 900,000,000 lb. of copper, certainly an impressive production before the payment of any return to the stockholders.

TAXATION MAY EQUALIZE COSTS

It seems to me altogether logical to believe that up to this time these South American companies have escaped in large measure the increased burdens of higher taxes which have seriously affected the prosperity of the domestic business, and that in the future this factor will tend to equalize between the two continents. So far as my information goes, I am inclined to believe that the higher wages paid in this country have been a little more than offset by the increased output per man employed. I believe that the production per man per day in this country is 50 to 75 per cent greater than in South America. For illustration, if the Chilean receives $1.50 per day for producing 100 lb. of copper, at 14c. he has produced a value over and above his wages of $12.50, while the American workman turning out 150 lb. and receiving $5 has yielded a margin of $16 above his wages. Although it is true that the American workman requires a larger share of capital in tools and equipment to secure this higher yield, he works so much more steadily and effectively, that, as we have seen, the investment per unit of product is less in the proportion of 3 to 4.5. Deducting this capital cost per man, which is the same, $4.50, in both cases, we find the margin reduced to $8 and $13, respectively, to cover all other costs than wages, to maintain the man in his work, together with whatever profit is made on his employment.

If we convert these margins to cents per pound produced, they appear as 8 and 8.7c. per pound respectively. The materials and power consumed, the costs of transportation, selling, administration, and other expenses, excepting taxes, probably differ very little in the aggregate, and we find that an advantage of 0.7c. still lies with the domestic producer.

This brings me back to the subject of my thesis, that if a tariff on copper is desirable or necessary, it must be on some other grounds than that of ruinous competition from South America. Without knowing much of anything about the subject, I am willing to hazard a guess that the same conditions surround the bogey of competition from Africa, judging from reports that have been received and from the South American experience.

The figures for 1923 show that at least 1,250,000,000 lb. of the world's output of copper, out of a total of 2,700,000,000, was produced with a margin of 4.5c. per pound. In other words, the industry has already reached more nearly normal conditions than many are prepared to contemplate. It is no great stretch of the imagination to believe that a selling price of 15½c. would fully restore the average margin, provided adequate relief is secured in the matter of tax reduction. Herein lies their greatest danger and their greatest hope.

Useful Operating Ideas

Drill Lubrication in Shaft Sinking

Where a number of jackhammers are used in shaft sinking, a manifold is generally used, to which the drill hose are attached. From four to six machines may be in operation at one time. A practical drill man suggests that under such conditions a sight-feed lubricator can be attached to the compressed-air pipe and the oil feed adjusted so as to supply all of the drills continuously with lubricating oil, which is carried along with the compressed air to each drill. Lubrication of individual machines is thus avoided and a definite saving of time results. As the drills are continuously lubricated and not intermittently, drill operation is facilitated and a materially higher all-round drilling rate is consequently obtained.

Design for Prospecting Headframe

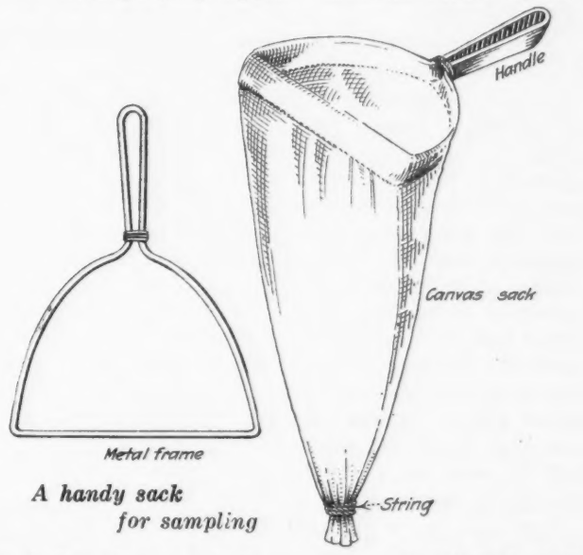
By H. D. Decker

The accompanying sketch shows the details of a simple wooden headframe suitable for a prospect or small shaft. In deciding upon the height of the headframe the factors indicated at *A* are first determined for the particular case. The direction of the rope and load forces and the resultant are shown at *B*. The stress diagrams for live loads are indicated at *C*. The design details are for 6x6-in. timbers. The main cross-tie below the sheave wheel is a 6x10-in. timber. The tie-rods are ¾ to 1 in. diameter.

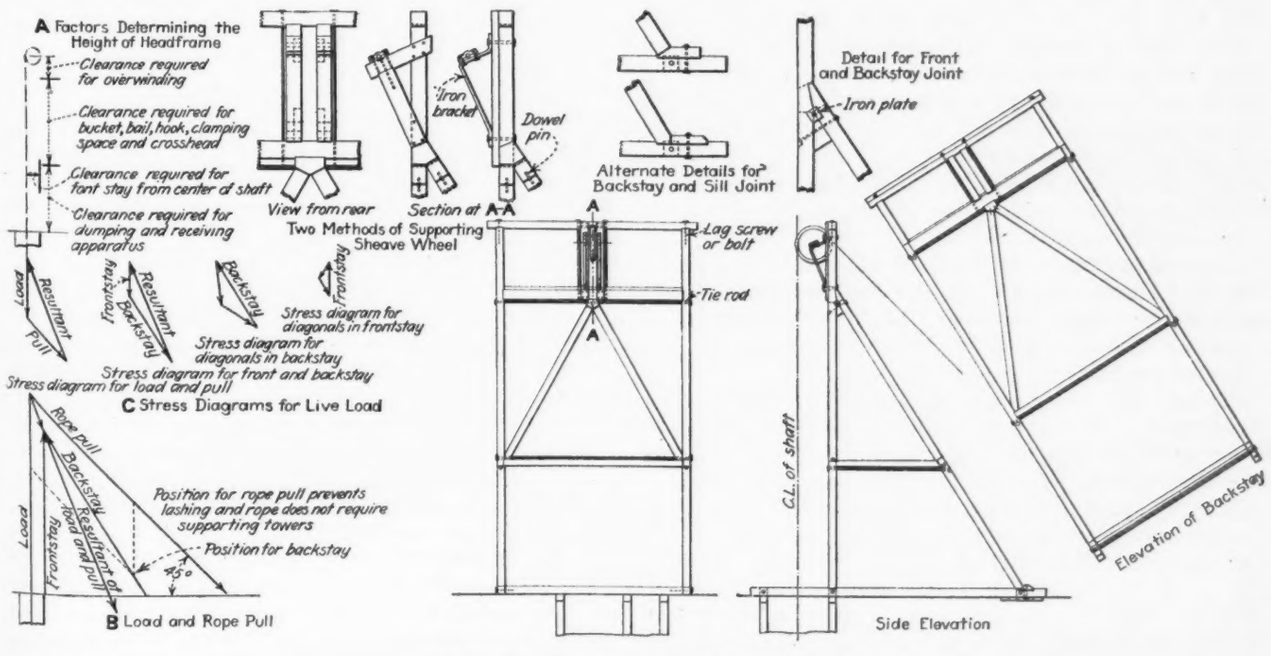
Sampling Sack

By E. B. Foster

A convenient sampling sack for receiving the sample as it is cut from the face of a drift or stope is shown in the accompanying figure. A metal frame is constructed as shown and a canvas sleeve is stitched to the frame. The free end of the sleeve is tied by a cord. The sample is transferred to the sample bag by unloosening the lower end.



A handy sack for sampling


A Factors Determining the Height of Headframe
Clearance required for overwinding
Clearance required for bucket, bail, hook, clamping space and crosshead
Clearance required for font stay from center of shaft
Clearance required for dumping and receiving apparatus
View from rear
Iron bracket
Dowel pin
Section at A-A
Two Methods of Supporting Sheave Wheel
Alternate Details for Backstay and Sill Joint
Detail for Front and Backstay Joint
Iron plate
Lag screw or bolt
Tie rod
Stress diagram for diagonals in frontstay
Stress diagram for diagonals in backstay
Stress diagram for front and backstay
Stress diagram for load and pull
C Stress Diagrams for Live Load
Rope pull
Backstay
Resultant of load and pull
Frontstay
Load
Position for rope pull prevents lashing and rope does not require supporting towers
Position for backstay
45°
B Load and Rope Pull
C.L. of shaft
Elevation of Backstay
Side Elevation

Design details of prospecting headframe

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Financing the Prospect

THE EDITOR:

Sir—I have just read the article of Arthur B. Parsons on "Financing the Prospect" in your issue of April 26. I have been a subscriber for your paper for a number of years, but I do not think you have ever published an article that presents the real facts better than does the one referred to. We have experienced and are now experiencing the very difficulties pointed out. We have what we consider to be an exceptional property near this city, consisting of some fifty-odd claims, of which seven are fully patented. On one of the patented claims we have open by tunnel a body of silver-lead-zinc ore 30 ft. in width. We have developed this for approximately 200 ft. This same orebody has been opened at two points above, so that we have about 275 ft. in back on the ore. This property is one that we would not be ashamed to show any one, and the more the party happened to know about mining the better it would suit us.

Our company is capitalized for only $2,500,000. We have the property free of all debt, and only about $1,400,000 in stock is outstanding. We started to finance through the "wide mouthed" "slicker" (as we later found out) stock salesman. This class tell too many lies, make too many promises and do anything they can to make sales, so as to get their commission. We soon got disgusted and looked for another way. Along came a smooth-talking New York market operator, and in his nice way showed us how easy it would be to get the necessary money. At first he wanted us to put up considerable money to finance the start (?) of operations. This we refused to do, but we did let him talk us into loaning him 50,000 shares of stock. Except for this concession we made a good contract for our company and the people that might have become interested, as the first block of stock was to net us 50c. per share—par $1—and the full sale was to net us 75c. per share. However, this New York so-called operator turned out to be just such a type as Mr. Parsons describes.

Things did not go as well as he expected at the start and he told us that we would get the money if we would just get busy and ship some ore, although we knew and so informed him that we could make no money shipping crude ore, as we have to pay a high hauling charge from the mine, freight costs, and smelter charges. Nevertheless, to help him out, so that we could get the money, we did ship twenty-two cars, and the result was that we made approximately $1,500 on the ore shipped, which had a gross value of better than $20 per ton. The net result of our experience with the New York party is that we still are unpaid for the stock we loaned him; and it seems we have no chance to collect, as we find he has his bank account in his secretary's name and other property, as far as we can find, is covered up the same way.

This makes us gun-shy of New York operators, and as we are through with the common class of stock salesmen, the question remains: How are we to raise a few thousand dollars to put a good mill on a property that will stand investigation by any one? Nearly all of the gamble has been taken out of our enterprise, but we have no way in which to get in touch with the people who want a real clean-cut run for their money. This is because of the fact that we cannot get the proposition before them, as the fly-by-night operator will not take a clean deal. We have had a dozen offers to finance the company providing we would take from 10c. to 25c. per share for treasury stock, but before we will do that we will just leave the ore in the ground to rot, as there would be no chance to give the people a real speculation if we flooded out stock on those terms.

We have even offered, direct to our stockholders, a first mortgage 8 per cent bond, payable in five years, or callable before by paying a 10 per cent bonus. With this goes a 100 per cent stock bonus. However, we do not get the money, because we will not pay 90 per cent of what we get in commissions.

You are doing good when you publish such articles, and in time, possibly, the people will learn. However, I doubt if you or the writer will ever live to see that day, as the people sure do like to hear the "bunk."

Butte, Mont. L. O. GOODMAN,
President Butte & Western Mining Co.

THE EDITOR:

Sir—Upon reading Arthur B. Parsons' arraignment of Jacob Simon Herzig and others, as published in the *Mining Journal-Press* of April 26, I am almost inclined to whisper hoarsely, *"Defens de rèpandre les haricots."* We gotta eat, you know; and you may offend some of the respectable and honest crooks that are smart enough to hire good lawyers *before* they do things.

A careful mental mastication and digesting of the article referred to indicates that the author presumes that most of the prospects will continue to be financed largely by the sale of mining stock, some of the proceeds of such sale being applied to actual development work. Very well. For a thorough understanding of the whole problem it is necessary to have a clear conception as to the psychological conditions of purchase of mining stock.

What percentage of the original or primary purchasers of mining stock (treasury stock, if you care to call it that) buy it with the intention and hope of getting their fair rate of interest, their extra interest for added risk, and their return of original capital, all out of the actual mine product? And what percentage buy with the intention and hope that somebody else,

who may think he knows more than they do about the actual present value of the stock at date of purchase, will take it over at a substantial increase over the "ground-floor" price?

Do you know the answer? I do not; but I have a rough idea that it is not 50-50 or anything like that.

To quote from the article, "Speculators may continue to lose their money more frequently than they win, but they will have the satisfaction of knowing that a *fair proportion* (italics mine) of the money they supply is going into the eternal gamble with Nature. . . ." That statement automatically eliminates the secondary purchaser from consideration. The money of the secondary purchaser goes into the custody of the primary purchaser and never into any gamble with old Mother Nature.

At the February meeting of the Institute, Lucius W. Mayer touched in a tentative way on the fact that almost every time a mining engineer calls on Lady Luck she is out lunching with some lawyer. And it is notorious as well as proverbial how long it takes some lawyers to finish. We mining engineers have the most unfortunate habit of concentrating our minds on technical topics—often to our own financial detriment. Figuratively speaking, we often strive to become experts at distinguishing beans from peas, instead of learning to assimilate some of the beans and peas, and how to cultivate them and acquire more.

The oats and the peas and the beans that are going to provide for the future development of many mine prospects are now, or will be, in the custody of the primary purchasers of mining stocks; and not one centavo will come directly from the second, third, fourth, or *ad nauseam* purchasers of the same stock. Any mining engineer who is a past master in the art of collecting that kind of oats and peas and beans is not likely to spend much of his time writing about it. No reflections on Mr. Parsons; he is paid to write interesting stuff and is making good.

Mr. Parsons, you, nor I, nor nobody knows where oats, peas, beans, and barley grows. Gosh! I forgot to cover the barley item. Rigorous obedience to the Volstead law has gotten me out of touch with old John Barleycorn. If I only had the acquaintance and confidence of a retired bootlegger I might go out and develop some prospects with money that has been diverted from the normal purchase of mining stock.

Yonkers, N. Y. WILLIAM B. MCKINLAY.

The Taxpayer Pays the Damages

THE EDITOR:

Sir—The Teapot Dome investigation will cost $1,000,000 if nothing more than the appropriated sums are spent. If it costs as lavishly as other investigations it will cost $3,000,000. This will be equal to the royalty due the government on the Teapot Dome for forty years, at present prices and at present rate of production. If it costs $3,000,000, then it will equal the royalty and all the government's interest for 120 years, or about five generations.

If there is not that much oil in the Teapot Dome, then all the people will have to pitch in and pay the taxes for that added difference between what this nation gets and what it spends on the Teapot Dome.

My knowledge of geology makes it positive that this Teapot Dome will not last over twenty years, and I am willing to wager my geological knowledge against that of any one on the governmental service who believes the Teapot Dome will last longer, for I have thoroughly investigated Casper, Wyo., Cat Creek, and Teapot Dome, and was not very favorably impressed with it as either an investment or anything else. Therefore, if the Teapot Dome does not produce more than twenty years at the present high prices of petroleum, it will have cost the people $500,000 out of their own pockets, and if it cost $3,000,000 to investigate it will have cost the American people $3,500,000 out of their own pockets.

This does not include the cost to the State of Wyoming, to the people who are both directly and indirectly interested, and to others who will be intimidated by coercion and conspiracy. If these are taken into consideration, the price of the Teapot Dome investigation will be over $100,000,000, at a conservative estimate.

I believe that something ought to be done to allow some real honest men to get in and investigate and run our government, for unless this is done, not only the oil industry but the mining industry will forever be throttled by demagogues, crooks, and thieves, who while pleading their loyalty to America, will be secretly getting all they can out of the people everywhere.

Fort Pierce, Fla. B. YORKSTONE HOGG.

Carbon Formation in Firebrick

THE EDITOR:

Sir—In commenting on the letter of Woolsey McAlpine Johnson, entitled "Electrothermic Zinc Reduction," published in your issue of March 29, 1924, I believe I cannot do better than call attention to the accompanying photographs, taken from a paper by

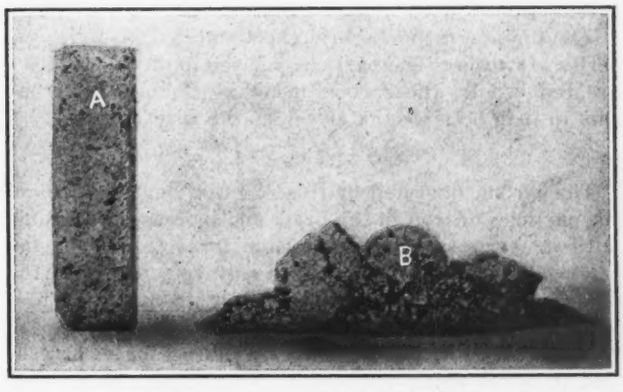


Fig. 1—A, Test piece of firebrick before exposure to carbon monoxide. B, Test piece of the same brick after exposure for twenty-four hours to carbon monoxide at a temperature of 550 deg. C.

myself and W. J. Darby, "The Disintegration of Refractory Brick by Carbon Monoxide," published in the *Journal of the American Ceramic Society*, August, 1923. The analyses of the bricks from which these test pieces were taken were as follows:

Firebrick	Per Cent
Fe_2O_3	3.72
SiO_2	64.34
Al_2O_3	25.83
CaO	Nil.

Magnesite Brick	Per Cent
Fe_2O_3	5.02
SiO_2	6.43
MgO	84.7

The test pieces were kept at a uniform temperature of 550 deg. C. in an electrically heated glass tube, through which a current of pure carbon monoxide was slowly passed, for twenty-four hours in the case of the firebrick and for fifty-three hours in the case of the magnesite brick. The results were as shown in the photographs. The disintegrated brick contained, respectively, 1.045 per cent and 1.056 per cent of elemental carbon, in sooty deposits where the specks of iron oxide had been in the original bricks.

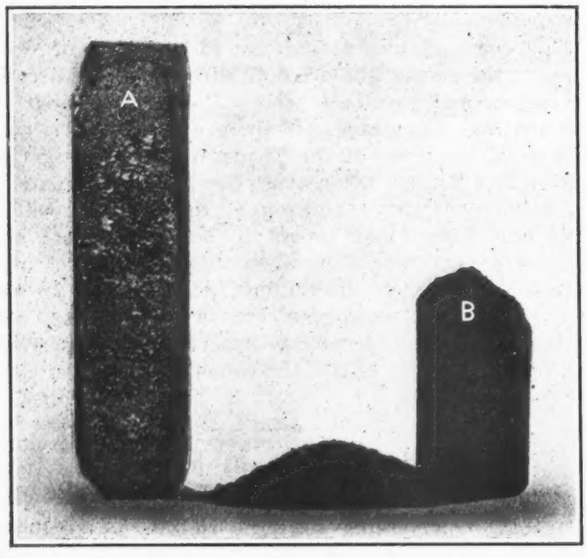


Fig. 2—A, Test piece from magnesite brick before exposure to carbon monoxide. B, Test piece of the same brick after exposure for fifty-three hours to carbon monoxide at a temperature of 550 deg. C.

The disintegration is brought about by the following series of causes: The particles of iron oxide in the brick are reduced by the carbon monoxide to metallic iron; this in turn acts as a catalyzer of the reaction

$$2CO = CO_2 + C.$$

The carbon liberated by this reaction deposits around the particles of iron in the brick and increases in volume until it exerts sufficient expansive force to disrupt the brick. This reaction takes place only very slowly in the absence of a catalyzer; consequently iron-free refractories such as iron-free firebrick and silica brick, or refractories in which the iron is combined in such form that it is not easily reduced at low temperatures, such as chrome brick, are not affected. Also, the reaction goes from left to right most markedly at moderately low temperatures, especially in the neighborhood of 500 or 600 deg. C.; at temperatures of 1,000 deg. C. and above, the reaction goes almost to completion in the opposite direction, and therefore refractories kept at a high temperature are not affected.

In the experiments mentioned, the test pieces were kept at a uniform temperature throughout the test, and no zinc vapor was present; hence the disintegration could not have been due either to ordinary expansion and contraction, or to the formation of zinc compounds, as stated by Mr. Johnson. Furthermore, in the experiments at East St. Louis with the Fulton zinc furnace, the lining of the distillation furnace, which was exposed to the full effect of the zinc vapor and to much greater and more sudden changes of temperature than the condenser, underwent no deterioration, whereas the condenser lining in those regions where the temperature was most favorable to the reaction $2CO = CO_2 + C$ was rapidly disintegrated and showed the characteristic carbon deposits. It was these carbon deposits which led to the discovery of the cause of the disintegration, and pointed out the method of overcoming it by the use of iron-free refractories.

This same disintegrating effect of carbon monoxide is found in iron blast-furnace linings, where it has sometimes erroneously been ascribed to zinc vapor, though various investigators have determined the true cause. In a paper "Disintegration of Firebrick Linings in Blast Furnaces," presented at the May, 1923, meeting of the American Iron and Steel Institute, C. E. Nesbit and M. L. Bell describe a recent extensive investigation of this subject. They carried out experiments similar to those of Mr. Darby and myself and arrived at similar conclusions.[1]

B. M. O'HARRA,
Associate Metallurgist, U. S. Bureau of Mines.
Rolla, Mo.

One Conception of Oxidation

THE EDITOR:

Sir—It seems to me that the way to regard the reduction of any metallic oxide is as an oxidation of the reducing agent and not the usual manner of a reduction of the oxide. The process is thus merely a flowing of oxygen from one "chemical pressure" to another and lower "chemical pressure"—so resembling the flow of water, electricity, or any substance.

Take the two-direction equation:

$$Al_2O_3 + 3Zn \leftrightarrows 3ZnO + 2Al$$

At 1,600 deg. C., the chemical pressures of the oxygen of the alumina and that of the oxygen of the ZnO are in the ratio of about 150 to 1 and the metal aluminum will reduce zinc oxide with explosive violence.

Now, zinc vapor can be brought and zinc oxide vapor can be removed from the sphere of action by an auxiliary current of a gas as hydrogen, and as soon as the back pressure of the ZnO as regards oxygen is reduced to less than 1/150 of that of the Al_2O_3, the reaction reverses and the weak zinc reduces the strong aluminum simply and solely because the oxygen *has to flow* from an area of high oxgyen pressure to an area of low oxygen pressure.

This operation can be applied differentially to low-silica, high-iron clays carrying considerable vanadium. Properly practicalized, it would be a new use for zinc and one that has a large future outlet. Though the ZnO could be recovered and re-reduced, yet the loss would be mounting up and reach a large total in time. The operation depends on the fact that both Zn and ZnO are vapors at 1,600 deg. C., which is not the case with most other metals. I have actually made good aluminum in such a manner. The process has a field in the future.

In conclusion, I might restate my opinion that the reduction of an oxide, or of any compound, for that matter, is regarded best as an oxidation process, the oxygen merely flowing from high pressure to low pressure—the conventional manner of regarding reduction giving a far less useful mental tool.

Argus, Pa. WOOLSEY MCA. JOHNSON.

[1] *Iron Age*, Vol. 3, pp. 1557-59, 1640-42, May 31, June 7, 1923.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

A REDUCTION of 18,000,000 lb. in the surplus stocks of copper is estimated for April. Refinery shipments total 234,000,000 lb., against an output of 216,000,000 lb. Decreased mine output should be reflected in the refinery figures for May.

A twenty-acre park and a $100,000 club house are planned by the Utah Copper Co. for the benefit of its employees at Garfield.

A plan to aid the development and financing of prospects in Colorado has been initiated by the Denver Chamber of Commerce.

Production of 350 tons of pig iron daily, at Provo, marks the establishment of an iron-mining industry in Utah.

Operations of the Mount Lyell Copper Mining Co., in Tasmania, netted £151,000 during the last fiscal year.

Floating of $500,000 in 7 per cent bonds to finance development and equipment is announced by the Engels Copper Co.

The Golden Cycle Mining Co. plans to construct its own steam-electric power plant at the Pike View coal mines owned by the same interests.

The Soviet Russian platinum will be marketed with a view to sustaining the current price, according to the representative of the Russian Currency Department in New York.

Money paid as interest on borrowed capital is reimbursable under the War Minerals Relief Act, according to the recent court decision in the Chestatee case.

Unofficial reports state that the Consolidated Mining & Smelting Co. will spend $1,500,000 improving its concentrator at Trail as a consequence of the recent signing of a contract to ship 100,000 tons of zinc concentrate annually to Belgium.

Large April Copper Shipments Reduced Surplus 18,000,000 Lb.

April Refinery Output Estimated at 216,000,000 Lb.—Curtailment at Mines To Be Reflected Soon

Further improvement in the statistical position of the copper industry was recorded during April, according to figures current in trade circles. To meet the demands of consumers, totaling 234,000,000 lb., surplus refinery stocks were again drawn upon to the extent of approximately 18,000,000 lb. This follows a reduction of 52,000,000 lb. of copper in surplus stocks reported in March. According to these estimates surplus stocks approximated 221,000,000 lb. against 239,000,000 lb. on April 1, about 311,000,000 lb. on Jan. 1, and 253,000,000 lb. on Oct. 1, 1923. Based on current sales, surplus stocks approximate a month's supply.

Domestic shipments for April came to 132,000,000 lb., with foreign 102,000,000 lb. This compares with domestic shipments of 160,000,000 lb. in March, and foreign of 111,000,000 lb.

The total shipments for the first four months of 1924 came to 954,000,000 lb., an average of 238,000,000 lb. a month, approximately 5 per cent greater than for any other four months' period in the history of the industry. Domestic shipments for the four months totaled 579,000,000 lb. Foreign shipments for the first four months totaled 375,000,000 lb.

Refinery output of 216,000,000 lb. in April compares with 220,000,000 lb. in March and 205,000,00 lb. in February, making refinery output for the first four months of this year 865,000,000 lb., an average of 216,000,000 lb. per month.

The production for April shows only a slight increase over that of the previous month. It is generally expected, however, that the refinery output of the current month will begin to reflect the curtailment program initiated at the mines in the first quarter of this year, inasmuch as it takes between sixty and ninety days for the mined product to go through the refinery and ore now being refined was mined either in the closing months of last year or the first two months of this year. As a result, reduced shipments from the refineries are expected.

Of the refined output in April, it is estimated that 8,000,000 lb. represent imports of copper from other continents than North and South America, together with scrap return. It is estimated that North and South American mine output at present time is approximately 185,000,000 lb. per month, making total intake at North and South American refineries and leaching plants approximately 193,000,000 lb.

North Star Mines Co. Will Develop X Vein

Plans Exploration at Plumbago Mine, Under Option—Rainbow To Be Relinquished

The proposed plan for sinking the present working shaft of the Nortn Star Mines Co. at Grass Valley, Calif, an additional vertical depth of 2,000 ft. to tap the X vein will depend upon the outcome of a three months' development campaign that will be concentrated upon this vein. The X vein contains a small but promising orebody, the only really good one that was discovered by 3,000 ft. of exploration work. As a matter of prudence this vein will be developed further before the decision to sink the shaft is made definitely, according to A. B. Foote, general superintendent for the company.

An option is being negotiated by the North Star Mines Co. for the Plumbago mine in the Alleghany district, Calif. Local reports announce the transfer of an option by the Ante-up Mining Co., which controls the property, to Robert Bedford, superintendent of the North Star mine. The North Star has explored the Rainbow mine in the same district, expending $51,246 on the property and extracting $28,302. It is believed that the option on the Rainbow will be relinquished.

Annual Convention of the American Zinc Institute

Among those who appear in this photograph, taken in front of the Hotel Chase, are: A. E. Bendelari, Joplin, Mo., elected president; Chas. T. Orr, Joplin, Mo., director and past president; F. C. Wallower, Joplin, Mo., director and past president; Eugene H. Wolff, Peru, Ill., director and past president; Howard I. Young, Mascot, Tenn., treasurer; Stephen S. Tuthill, New York, secretary; Percy B. Butler, Joplin, Mo., director; A. P. Cobb, New York, director; A. M. Gains, Picher, Okla., director; Julius W. Hegeler, Danville, Ill., director; Frederick W. Holler, La Salle, Ill., director; John W. Newton, Cardin, Okla., director; Wm. F. Rossman, St. Louis, Mo., director; Jesse G. Starr, Joplin, Mo., director; Arthur Thacher, St. Louis, Mo., director; Richard Jenkins, Webb City, Mo.; P. R. Coldren, Joplin, Mo.; D. A. Lyon, Washington, D. C.; R. S.

Granby Drops George Copper Group Option

The Granby Consolidated Mining, Smelting & Power Co. has released its option on the George Copper group, at the head of Bear River, Portland Canal division. This has been rendered necessary on account of the company's determination to concentrate its efforts on cheapening production during the depressed copper market, and with this in view it will curtail outside exploration. The Eagle and Anaconda groups, adjoining the Outsider mine, which it acquired last year, are the only properties that it proposes to explore during the coming summer. Diamond drilling has shown that these two properties give considerable promise, and with the Outsider should make a good producer.

Granby has a 99¾ per cent interest in the Allenby Copper Corporation, which has a reserve of about 6,000,000 tons of 2 per cent ore standing idle, but in readiness to take any advantage of an improvement in the present state of the copper market.

Engels Copper Issues $500,000 Bonds to Finance Development

The Engels Copper Co., operating in Plumas County, Calif., will issue in the near future $500,000 of ten-year, 7 per cent convertible debentures. Part of the proceeds ($380,000) of the bonds will be used for the purpose of developing orebodies between the seventh and tenth levels of the Engels mine and the third level of the adjoining Superior mine. The remainder will be used for new construction.

The company recently completed the construction of an 8,000-ft. adit, opening up the tenth level of the Engels mine. The availability of this capital will enable the new development to be accomplished at a minimum expenditure of time.

Trail Concentrator Improvements to Cost $1,500,000

AS A CONSEQUENCE of the closing of a contract to deliver 100,000 tons per annum of high-grade zinc concentrate to Belgium, $1,500,000 will be spent this season in enlarging the concentrator of the Consolidated Mining & Smelting Co., at Trail, B. C. The concentrate will be shipped by water from Vancouver, B. C., with Welsh coal as return cargo.

Important Strike in Sangre de Christo Tunnel, Cripple Creek

The recent strike in the Sangre de Christo tunnel, on Tenderfoot Hill, in Cripple Creek, after two weeks' development, is pronounced by Mine Inspector McCarthy as one of the most important made in the camp for several years. Outside of what has been considered the producing district, six cars of ore have been shipped from about 50 ft. of recently performed development work.

A vein of pay ore from 10 to 15 ft. in width has been disclosed. The discovery was made by the Metals Reclamations Co., financed by Denver, Colorado Springs, and Cripple Creek parties.

Rich Oreshoot at Talache

The Talache Mines Co., operating a silver mine at Talache, Idaho, is developing a narrow shoot of high-grade silver ore north of the Big fault between the 900 and 1,200 levels.

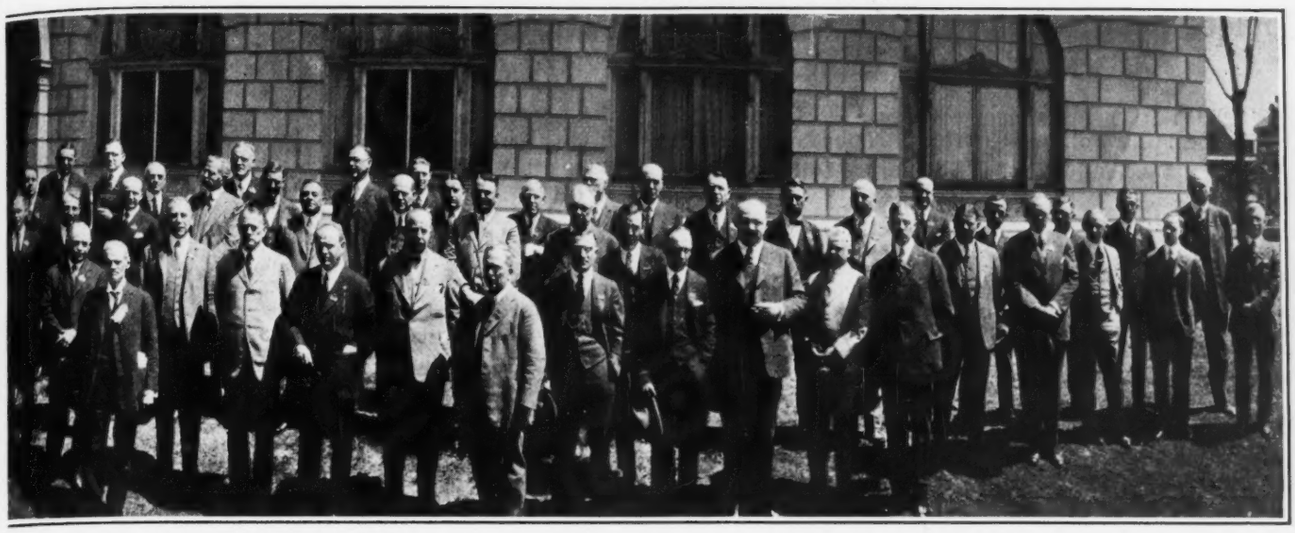
Recently the mill has been put on a two-shift basis and it is hoped to continue operations on this scale. The next work will be to sink below the 1,200-ft. level, which is at present the main haulage adit.

Tax on Unworked Mineral Lands in Alberta Illegal

The Dominion Government of Canada has disallowed the act heavily taxing mineral lands in Alberta that were not under development. This act was passed by the Alberta Legislature during the 1923 session, but now will not be placed on the statutes. The Canadian Pacific Ry. Co., the Hudson's Bay Co., the Calgary Land Co. and other concerns that own millions of acres of mineral lands in Alberta protested against the act becoming law, contending that it was impossible to exploit the whole of this immense area and that the imposition of the tax provided by the act amounted to nothing short of confiscation. The Federal Department of Justice held that the act was practically, if not designedly, of a confiscatory nature and therefore was *ultra vires*. On the other hand, there can be no gainsaying that the holding of this immense area in an undeveloped condition is retarding the mineral development of Alberta. It is hoped that arrangements will be made whereby exploitation may soon become an accomplished fact.

Hewer Concentrator, at Lake View, Idaho, Progresses

The concentrator being erected on the Hewer mine, near Lake View, Idaho, is being pushed rapidly and it is expected that it will be in operation by July 1. The mine lies at an elevation of 1,100 ft. above Pend Oreille Lake, and it will be necessary to haul concentrates by truck to the lake, where large barges containing railroad cars will be loaded and towed across the lake to Bay View, the terminus of the railroad. About 60,000 tons of lead-silver ore has been blocked out at the Hewer mine, and current development is adding to the tonnage of available mill ore.



Held at St. Louis, Mo., on April 28 and 29

Butler, Joplin, Mo.; H. B. Cobban, Miami, Okla.; Alton D. Edes, Plymouth, Mass.; John R. Gano, Danville, Ill.; Edw. S. Gellatly, New York; Howard P. Hart, Waterbury, Conn.; Edw. C. Hegeler, Danville, Ill.; Daniel Hinchcliffe, Muncie, Ind.; H. T. Hornsby, Joplin, Mo.; R. B. Jensen, Baxter Springs, Kan.; Walter L. Kelley, Danville, Ill.; Wm. Lanyon, St. Louis, Mo.; W. E. Mitchell, Great Falls, Mont.; Emmett L. Murphy, Chicago, Ill.; Edward V. Peters, New York; James H. Polhemus, New York; C. L. Proctor, Joplin, Mo.; Ralph M. Roosevelt, Hillsboro, Ill.; Carl Y. Semple, Baxter Springs, Kan.; George C. Stone, New York; Harlan H. White, Joplin, Mo.; J. H. Wadleigh, Joplin, Mo.; C. W. Martin, Greencastle, Ind.; H. A. Buehler, St. Joseph, Mo.; E. M. Johnson, Joplin, Mo.; J. F. Callbreath, Washington, D. C.; E. Talcott Barnes, La Salle, Ill.

Golden Cycle Mill Will Get Power from New Plant

A. E. Carlton, who directs the operations of the Cresson mine, the Golden Cycle mill, and coal mines at Pike View, and who is the leading spirit in many other Cripple Creek and Colorado Springs enterprises, announces that the Golden Cycle Mining & Reduction Co. will at once proceed with the construction of a steam plant at the Pike View coal mines to supply electric energy for the Golden Cycle mill. Ultimately the transmission line will be extended to Cripple Creek. Mr. Carlton says:

"We have from time to time postponed the construction of our power plant, hoping the coterie who have in the recent past controlled public affairs in Colorado Springs would adopt some constructive policy on the light situation. It is now evident the policy of destructive warfare is to be continued and our company cannot afford either to be the victim of high costs incident to political management or the uncertainties and hazards of future operations of the Colorado Springs Light, Heat & Power Co."

The Golden Cycle mill uses annually approximately 8,000,000 kw., or 40 per cent of the total power distributed by the Colorado Springs Light Co.

Gila County, Ariz., Gets Big Income from Copper Mines

The following taxes paid by the mining and smelting companies in Gila County, Ariz., representing a half-year's payment, afford an example of the huge sum that is paid as taxes by the large mines of the West: Inspiration Consolidated Copper Co., $362,328.89; Miami Copper Co., $233,863.73; Ray Consolidated Copper Co., $37,066.92; Old Dominion Mining Co., $81,546.62, Iron Cap Copper Co., $12,977.31; International Smelting Co., $58,388.51, and the American Smelting & Refining Co., $22,139.39.

The Lure of Digging

JACOB ESCH, ninety years old, with plenty of money in the bank to assure luxury the rest of his life, even if he should pass the century mark, has left his home in Oregon to direct the development of his claims on Grouse Mountain, near Leonia, Idaho. Mr. Esch's sister will take charge of the camp kitchen. Mr. Esch made important discoveries in Harney County, Ore., last season, which he bonded to local people.

California Rand Silver Returns to Two-Shift Mill Schedule

A large increase in the amount of reserve ore broken in the mine during the period of mill curtailment has enabled the California Rand Silver Co., operating at Randsburg, Calif., to change from a one-shift to a two-shift basis in its concentrator. About 230 tons of ore per day will be milled under this schedule.

The 722 drift from No. 6 shaft has entered good ore at a point 165 ft. below the original discovery point of gold in the Williams vein, in the 1,104 north drift. Developments between the seventh and eighth levels in the main workings have disclosed a substantial body of high-grade silver ore.

During April 3,459 tons of ore was milled with an average value of $23.60 per ton; 97.12 per cent of the silver was extracted.

Topographic Survey Started at Alleghany, Calif.

Work on the topographic survey of the Alleghany district, Calif., has been started by the U. S. Geological Survey. On the completion of the topographic map, geological work will be begun and the district thoroughly studied.

Mining Corporation Does Well in South Lorrain Area

The annual report of the Mining Corporation of Canada, which will be issued soon, will show a production of approximately 2,250,000 oz. of silver recovered from the various operations. A large part of this production came from the properties in the South Lorrain area, in northern Ontario, on which $1,600,000 has been expended to date.

A few days ago the company recovered a record piece of ore from the fifth level in the Watson vein. The original piece of vein, which had a width of 22 in., weighed about two tons and assays between 12,000 and 14,000 oz. to the ton.

On the Lorrain Trout Lake, in which the company has a one-third interest, the high-grade shoot at the 75 level has been opened up for a length of 123 ft., and varies in width from 2 to 15 in. of high-grade ore. In addition there is a considerable tonnage of milling ore available; and with the completion of the South Lorrain Ry. it is expected that some time this fall approximately fifty tons a day will be shipped to the Corporation mill in Cobalt.

Find Ore in Colorado Shaft in Mohave County, Ariz.

According to Frederick W. Haecker, two important strikes have been made in the copper properties being developed by him in the Mineral Park district, in Mohave County, Ariz. The Colorado shaft has cut six feet of copper ore containing chalcocite, bornite, and about 18 oz. of silver, at a depth of about 60 ft.

The second find is an intrusive mass of monzonite porphyry well impregnated with copper minerals. Mr. Haecker and his associates have an option on fifty-two claims in the vicinity. They have already spent more than $25,000 in development and expect to continue work.

Soviet Government Will Market Russian Platinum Production Judiciously

Representative of Moscow Currency Department, Now in New York, Explains Policy—Current Production in Russia 45,000 Oz. Annually—Will Operate to Sustain Market

By F. E. Wormser
Assistant Editor

RUSSIAN platinum will not be dumped upon the world market so as to demoralize prices and market conditions, according to a statement by the representative of the Currency Department of Moscow—Dr. Maurice Laserson—who is now in the United States to study the precious metals situation. Those producers, refiners, dealers, and consumers who have been disturbed lately over the prospect of a reviving Russian platinum mining industry will find Dr. Laserson's views of great interest, coming as they do from one who has had long and intimate contact with the Russian platinum market.

Soviet Platinum Marketed Through a Trust

In 1916 and 1917 Dr. Laserson was Commercial Director of the Lyssva Mining District Co., commonly known as the Shouvaloff Co., with headquarters in Petrograd. About one quarter of the world's production was produced by this company. Dr. Laserson was asked to state his views as to conditions in the Russian platinum-mining industry and the policies which would be pursued in marketing the Ural production. All Russian platinum is now produced through one of the trusts that have been organized by the Soviets. This particular trust is called "Ural-Platina." The whole Soviet Russian output of platinum is delivered by Ural-Platina to the Currency Department of the Commissariat of Finance in Moscow, which is in charge of the platinum, and ultimately disposes of it.

Dr. Laserson states that he has come to the United States for the purpose of making a careful study of the American platinum market—the most important so far as consumption is concerned, consuming about half the world's production. "I am not going to conclude for the present in the United States any concrete transaction for the sale of platinum," said Dr. Laserson, "but naturally my study will be a basis for future decisions of the Currency Department. The Currency Department has decided to act with the greatest care in the question of sales of platinum, as the market is a very peculiar one, extremely sensitive to changes in supply, and highly delicate. The Currency Department will handle sales of platinum with due regard to the leading factors in the United States and Europe. Under no condition is the Currency Department going to throw suddenly on the market any quantity of platinum whose consumption would cause serious difficulties, and which would tend to disturb the equilibrium of stable market conditions. Soviet Russia, as well as other producing countries and refiners, dealers, and consumers everywhere, is interested in a steady market, for it inspires confidence and encourages production as well as consumption."

Before the war Russia produced nearly all of the world's platinum—over 95 per cent—approximately 200,000 to 250,000 oz. yearly. At that time French interests virtually had a monopoly of the output owing to agreements with the leading producers. Production fell off sharply during the war, and Colombia, South America, became an important producing country. At present production in the Urals amounts to about 40,000 to 45,000 oz. per year and is gradually increasing. This is a higher rate than the output of Colombia which is around 35,000 oz. annually.

Dr. Laserson says that the cost of mining platinum has increased so much in comparison with pre-war standards that no producers can mine the metal at a level which would allow a serious decrease of the present market price. "In addition," said Dr. Laserson, "so far as Soviet Russia is concerned, all efforts are being made to raise production, but nevertheless the output of platinum in Soviet Russia will remain comparatively limited, and pre-war figures of production can scarcely be approached."

American mining equipment, notably Marion and Bucyrus dredges, is found in the Soviet Russian platinum fields.

May Open Old Vancouver Island Gold Placers

San Francisco interests are examining placer gold deposits on Lost and Sombrio rivers, about 50 miles northwest of Victoria, B. C. These deposits were worked for several years prior to 1912, and a hydraulic plant was installed. The average value of gravels was low, however, and the operations were not profitable, though fairly rich benches were found. The gravels were worked by the early Spanish settlers on Vancouver Island, and evidence of their operations still is to be found in many localities.

Lone Pine Ships Gold from Mine Near San Diego

The Lone Pine Mining & Milling Co. is operating a mining property in the Laguna Mountains, San Diego County, Calif. The company in October, 1923, acquired the North Hubbard and Ready Relief mines in the Banner and Julian gold mining district, situated near Julian, Calif.

Until recently a five-stamp mill was operated and shipments of gold bullion were made. A fifty-ton mill was recently installed. The mine is under the management of J. F. Krebs and employs twenty-five men.

Iron Mining in Utah Now an Established Industry

THE production of pig iron in Utah is an accomplished fact. On the afternoon of the last day of April, the Columbia Steel Company drew off the first twenty tons of pig iron from its recently completed blast furnace at Ironton about 50 miles south of Salt Lake City. Since that time, it is announced, 500 tons of pig iron from the new plant has been shipped to California.

In about thirty days it is expected production will be at the rate of 350 tons daily, which tonnage will secure the smooth working of the plant, and will supply the present demand of the company's mills. The output of the furnace can be increased. Utah mining men look for the exploitation of the large resources of both iron and coal in the state.

Michigan Mining Engineer Reports Copper District Conditions

Tax Commissioners May Alter Method of Valuation—Present Scheme Based on Stock Market Quotation

A sharp decrease in the assessed valuation of Michigan copper properties, as well as in the listed values of dwellings and business structures in the copper country, is expected when the Michigan state tax commissioners give consideration to a survey now being prepared by L. P. Barrett, State Mining Engineer. Mr. Barrett, who has just completed an investigation in the copper district, will report that out of all the companies that once operated Michigan copper mines only five are now raising ore and that only three are operating at a profit. Moreover, Mr. Barrett points out, these five are selecting ore of the highest copper content and thereby, for the time being, are showing what might be termed abnormal results.

Valuations of Michigan copper properties for taxation purposes have been based in recent years on stock market quotations. The market price of the shares each Monday in the year is averaged, and this mean multiplied by the number of capital shares gives the valuation. A concession is made in favor of non-producers or prospects and producers which are not dividend payers. The percentages vary each year, but as a rule dividend payers are taxed on a valuation 90 per cent of that fixed by the stock market method; producers not in the dividend class on a valuation of 60 per cent; and non-producers or prospects, 40 per cent. Though the system has been generally satisfactory, it has happened in the case of some of the smaller non-producers or prospects, when the price of their shares averaged abnormally high for the year, that the tax burden has fallen quite heavily. State, county, township, and other general taxes are collected from the mining companies on

N. Y. Zinc Co. Gets Special Pump for Flooded Workings

AT THE zinc property of the New York Zinc Co., Edwards, N. Y., progress is being made in unwatering the mine, which was recently flooded. Drilling operations at the 1,100 level opened up a subterranean stream, and the lower 400 ft. of the mine was flooded.

A special pump of 1,400-g.p.m. capacity was made to order by the Layne & Bowler Co., of Memphis, Tenn., and shipped to Edwards by express at a cost of over $1,000. This pump has been hooked up in the shaft and discharges into a reservoir on one of the upper levels. Smaller pumps push the water from here to the surface. The water has been lowered more than 100 ft. It is estimated it will cost $50,000 or more to clear the mine.

this basis. Whether the system will be abandoned this year remains to be seen. It is possible the physical valuation plan, based on the survey made by Mr. Barrett, State Engineer, may be adopted by the tax commission.

Utah Copper Plans Big Park and $100,000 Club House

Planting of 750 Trees Near Magna Concentrator Starts Project—To Be Open to the Public

The Utah Copper Co. is continuing its policy of supplying comfortable housing and recreation facilities for its employees. The eighty-seven new cottages built in the vicinity of the various plants of the company during the last ten months and the Gemmell memorial club house in process of construction at Bingham have been mentioned in these columns, and now comes the announcement of a new twenty-acre park to be laid out near the company's mill at Magna, and of a $100,000 club house for the Arthur plant. In all, the company plans during 1924 to spend $310,000 for betterment. Thus far $410,000 has been spent in such work. The starting of the park was made the occasion of a celebration on the afternoon of May 2, when 750 trees were planted.

Louis S. Cates, general manager of the Utah Copper, on that day made the announcement of the new club house for Arthur, and Governor Mabey was the chief speaker. Both Mr. Cates and Governor Mabey planted trees. About 4,000 people were present at the celebration.

The new park will be open to the public, but title will be held by the Utah Copper Co. There will be a swimming pool, a grandstand, a barbacue pit, bleachers, a parking space for automobiles, and of course a baseball field, the latter encircled by a running track. Half of the park will be given over to a children's play ground, dancing pavilion, a bowery, wading pool and a fish pond. There will also be lawns and flowers.

News from Washington

By PAUL WOOTON
Special Correspondent

Chestatee Wins W. M. R. Suit

Should Be Reimbursed for Interest Paid on Borrowed Capital—Analogous to Old Civil War Case

INTEREST on borrowed capital constitutes a legitimate item of expense reimbursable under the War Minerals Relief Act, in the opinion of the Court of Appeals of the District of Columbia. Decision to that effect was announced on May 12 in the appeal taken by the Secretary of the Interior from the judgment of the Supreme Court of the District of Columbia. The case is that of the Chestatee Pyrites & Chemical Corporation. Extracts from the text of the opinion are as follows:

"It appears that when the United States entered the war, relator was the owner of a pyrites mine which it operated on a limited scale. In compliance with the demand upon it by the government, in the way of enlargement of its plant to meet the war necessities, it was compelled to borrow the sum of $695,000, on which it obligated itself to pay interest at the rate of 6 per cent per annum.

"A claim was made by relator . . . for reimbursement for the loss sustained by reason of its compliance with said request or demand. After three separate hearings and adjudications in the Department of the Interior, relator was awarded $693,313.79. In making the award the item for interest on the $695,000, borrowed as aforesaid, was disallowed. It is to compel the adjudication and allowance of this claim that the present suit was brought.

" . . . Whatever the provision in the statute 'that the decision of said Secretary shall be conclusive and final' may mean, it has no bearing upon this case, since no adjudication upon the merits was made. The claim was disallowed solely upon the ground that there was no statutory authority for the adjudication and allowance of such a claim. We are called upon, therefore, to review merely the interpretation placed upon the statute by the Secretary—not to review an adjudication based upon issues of fact.

"This narrows the case to the single question of law, whether the item of interest is embraced within the claim for net losses incurred by relator. The statute, among other things, provides: 'that all claimants who, in response to any personal, written, or published request, demand, solicitation, or appeal from any of the government agencies mentioned in said act, in good faith expended money in producing or preparing to produce any of the ores or minerals named therein . . . shall be reimbursed such net losses as they may have incurred and are in justice and equity entitled to from the appropriation of said act.'

"Closely analogous to the situation here presented is a case arising out of the Civil War, where . . . Congress passed an act providing for the reimbursement of any state raising troops to protect the nation for 'the costs, charges, and expenses properly incurred.'

"To meet the call from the government, the State of New York appropriated money to arm and equip troops, and issued 7 per cent bonds to raise the money. In adjusting the claim of the state, the department reimbursed it for the amount actually expended, but refused to pay the interest which the state had to pay on its bonds. The facts in that case are the same as in this, excepting that in this case the relator corporation is claiming for interest which it had to pay on its notes."

The Supreme Court held the Federal Government liable for interest. The present decision continues:

"This is not a claim for interest upon an amount due the relator from the government, but for expenses incurred in performing certain duties required of it by the government. It is not compensation for the use of money due the claimant from the government, but for money paid by relator in order to secure the means with which to meet the demands made upon it by the government. . . .

"Being, therefore, an element of the expenses incurred, we think that in equity and justice the interest paid or obligated to be paid in this case should be allowed. The statute is remedial, and should be construed liberally in order to carry out the purposes of its enactment."

Some Get It; Others Don't

Findings of net loss under the War Minerals Relief Act have been approved by the Secretary of the Interior as follows: J. C. Raynor, Atolia, Calif., $1,776.83; Curley Manganese Co., Imperial County, Calif., $2,583.36; Bulkeley Wells, El Dorado County, Calif., $6,016.55; Boulderado Mining & Milling Co., Boulder County, Colo., $9,600.30; A. H. Laton, Cadazero, Calif., $589.18; John D. Whitney, Glenn County, Calif., $146.04; Mark F. Hopkins, San Jose, Calif., $4,095.21; West, Ross and Hill, Placer County, Calif., $208; Lee Payton, Amador County, Calif., $280; Manganese Development Co., Napa County, Calif., $280.87; Piedmont Pyrites & Mineral Corporation, Radiant, Va., $3,400.07: S. A. Goultrie, San Luis Obispo County, Calif., $2,230; E. T. Ellis, Livermore, Calif., $681; Alex R. Sheppard, White Pine County, Nev., $183.27; George Cartwright, Amador County, Calif., $2,124.65; George W. Vanderwalker, Santa Cruz County, Calif., $2,431.62; A. G. Lewis, Atascadero County, Calif., $5,916.71; Gallagher and Grasselly, Tuolumne County, Calif., $805; Theodore C. Hall, Fresno County,

Calif., $686.25; Finche & Threckel, Placer County, Calif., $495.33; G. C. Brown, Gazelle County, Calif., $521.25; L. R. Baker, Boulder County, Colo., $1,999.04; McCorkle and Andrews, Grant County, Ore., $420; A. J. Schmidt, Nevada County, Calif., $1,114.17; A. S. Adams, Vesuvius, Va., $788.66; L. C. Morgan & Co., Mendocina County, Calif., $3,059.92; Lambert & Potter, Siskiyou County, Calif., $48; N. Lambert, Siskiyou County, Calif., $114.68; McDonald, Bolmes & McCarthy, Kirkland, Ariz., $1,050.35; Barney P. Silva, Sierra County, N. Mex., $1,720.05; C. E. Jones, Siskiyou County, Calif., $750.

The following claims were dismissed because of failure to come within some one of the various requirements of the law: Frank Edison, Ogden, Utah; B. F. Melville, Plumas County, Calif.; Morgan M. Day, Santa Clara County, Calif.; Mineral Ridge Mining Corporation, Frederick County, Calif.; George V. Borchsenius, Red Mountain, Calif.; Fanno and Hamilton, Inskip, Calif.; John Langman, Nevada County, Calif.; Cleveland and Mitchell, Martinez, Calif.; Manganese Mining Co., Santa Clara County, Calif.; Frank H. Proctor, Madrone Station, Calif.; J. O. Phillips, Riverside County, Calif.; D. G. Walton, Fresno County, Calif.; Allies Mining Co., Humboldt, Nev.; James O'Brien, El Dorado County, Calif.; Edmunds and Buchanan, Winnemucca, Nev.; W. F. McMurtry, Fresno County, Calif.; Jacob See, Santa Margarita, Calif.; Buckeye Tungsten Corporation, Atolia, Calif.; Arthur Watts, Placer County, Calif.; E. I. Bartholomew, Nevada County, Calif.; Shenandoah Valley Manganese Corporation, Stanley, Va.; Red Cross Leasing Co., Humboldt, Nev.; Charles C. Kirk, Mendocino County, Calif.; Randsburg, Atolia Tungsten Mining Co., Kern County, Calif.

Good Ore in Great Bend Mine at Diamondfield

Interest is centered in the recent developments in the Maroni lease on the Great Bend mine, at Diamondfield, near Goldfield, Nev. A small cross fissure, with a strike almost at right angles to that of the main vein, was followed with a raise from the 236 level, and at 10 ft. above the level the streak widened to 3 ft. of pay ore. An intermediate drift has been driven from the raise, and is out 20 ft. in ore which is said to run $40 per ton in gold. The Great Bend company expects to start company operations on the 165 level to prospect for the upward continuation of this new oreshoot.

Alaska Juneau Again Makes Profit

Alaska Juneau in April, 1924, mined and trammed to mill, 257,800 tons, which yielded $161,000 or 62.68c. per ton. Operating expenditures were $132,800 or 51.51c. per ton, leaving an operating profit of $28,800 or 11.17c. per ton. During the month additional expenditures, including capital account $7,500, Ebner mining property $2,400, and interest on indebtedness $15,150, totaled $25,050, leaving a surplus of $3,750 for the month.

London Letter

By W. A. Doman

Special Correspondent

South Crofty, Cornwall, Resumes Quarterly Dividend Payments

Tin and Arsenic Help Situation—Wolfram Drug on Market Because of Chinese Imports

London, April 29 — So far as the mining business is concerned tin has been the outstanding feature of the last week. Despite the Easter holidays, which made a big gap in the working period, speculation in the metal was active while dealings were possible. Francis Allen, chairman of South Crofty, Cornwall, speaking at the shareholders' meeting, said that the law of supply and demand did not appear to hold good in regard to tin, speculation being the dominating influence. Some of the weak bulls have been cleared out, and it is not yet certain that bears have closed their commitments. Presumably in order to assist their operations they have quoted extensively some recent tin statistics given by the *Mining Journal-Press*, and ask whether any further explanation of the weakness of the price is necessary.

Stocks are not large as stocks go, and the Malay Government is disposing of its hoard at the agreed-upon rate, so that an improvement upon the existing price of £244 is looked for. This price of course enables almost every mine to be worked remuneratively, but there is always a hoping for, if not a struggling after, higher prices.

The present level and substantial forward sales of arsenic have enabled the directors of the South Crofty to resume payment of quarterly dividends. Though arsenic is playing its part in making a return to the shareholders, wolfram is very much neglected; in fact, it is unsalable, except at low prices. For this there are two reasons —one, China is sending wolfram into this country duty free at a price against which it is impossible for an English company to compete, and secondly the large stocks of wolfram left over since the war.

The directors of South Crofty and Tincroft and East Pool & Agar are not yet on good terms, apparently, as regards the pumping problem. Two years or so ago this question was acute, and some of the companies ceased pumping, which meant that their water drained to the South Crofty and was pumped from that mine without any recompense. It was the action of South Crofty that kept Tincroft and the old East Pool & Agar workings clear to a depth of 150 fathoms and enabled the last mentioned to crosscut and ventilate.

The East Pool & Agar is doing well, and now that the price of tin is relatively high the cry is again heard "Who says that Cornish mining is dead?" At the South Crofty meeting a bonus was voted to the directors and also to the manager. Shareholders do not object to these payments altogether, but they do say sometimes that even a vote of thanks—if nothing more substantial—would be appreciated by the miners.

A mine in the neighborhood of Penzance, bearing the name of the Ding Dong, is to be reopened. No technical reports are published, but local opinion is quoted and a list of sales of tin from the year 1850 to 1878 is given. Messrs. T. R. Bolitho & Sons, the tin firm, are connected with the undertaking.

The Hampton Properties (West Australia) has had to write down its capital from £463,317 to £87,263—namely, from 20s. a share to 4s. Things have not turned out on this field as expected, and there has even been trouble at the Celebration mine. Values have been patchy at both properties, but the Celebration is reported to be looking better at 400 ft. Hampton Properties is endeavoring to secure control of the Celebration.

Mount Lyell Copper Operations Continue Profitable

Current Output 10,000 Tons of Ore Per Month—New Smelting Practice Successful

Brisbane, April 5.—The new smelting practice initiated in 1921 at the Mount Lyell copper mine in Tasmania, Australia, has proved entirely satisfactory, and the company is in an excellent position. The present output is about 10,000 tons of ore per month, and it is said that if sufficient labor were available to hasten development of the mine the production could be increased to between 11,000 and 12,000 tons.

One furnace continues in regular operation, and the sintering and concentrating plants, which are working well, are also working constantly. An addition is being made to the latter by the installation of an experimental separation table, which it is understood will be used to deal with high-grade bornite material contained in the ore residues after they have been through the regular concentration and flotation processes.

As to the Mount Lyell mine, at the 1,100, 1,000, and 925 levels all stopes are maintaining their customary good values, both in quality and quantity. At the 850 level a winze being sunk at the northern end of the workings continues in ore of excellent grade, demonstrating that the large orebody is maintaining good value on its downward strike below the 850 level.

The Mount Lyell accounts for its last financial year show that the profits of the company for the term amounted to £151,000, and that its surplus liquid assets over liabilities were valued at more than £737,000.

France Prohibits Copper Exports

Terms of a ministerial decree dated March 25 strictly prohibit the export out of France of copper and its reexportation from bonded warehouses or in transit, according to a recent announcement by the Foreign Department of the Bankers' Trust Co. The decree applies also to all scrap copper or alloys containing a percentage of copper, and to residues from chemical processes which might contain a trace of copper.

Montana-Idaho Copper Co. Plans Resumption at Adair

The Montana-Idaho Copper Co. has been incorporated with a capitalization of 3,000,000 shares, and the property situated at Adair, Idaho, has been transferred and the deeds have been recorded. According to W. J. Kirby, secretary-treasurer, the company expects to resume operations as soon as sufficient funds are available.

Drifting will be resumed westward on the vein in the old workings at a depth of 1,800 ft. and at a point 9,000 ft. from the portal of the main adit, which is about two miles long. The immediate objective is the area in which the ore should be found in its westerly rake from the upper levels.

A majority of the old stockholders have surrendered their stock for exchange. The new board of directors includes H. B. DeBower, of New York; John L. Dirks, of Spokane; Otto J. Pieper, of Wallace, Idaho; and George B. May, of Tekoa. S. P. Burr is superintendent.

New Plan to Stimulate Mine Development in Colorado

Denver Chamber of Commerce Has Sundry Ways of Helping Prospector—Free Assays—Assists in Interesting Capital

The Denver Chamber of Commerce, in conformance with a well-defined and organized plan to foster and encourage renewed mining activity throughout the metal-mining districts of the state, has appointed a committee, to be known as the Prospecting Committee, which, in co-operation with the Colorado Metal Mining Association, the Colorado School of Mines, the U. S. Geological Survey, and the State Geological Survey, will formulate a plan for the scientific and systematic investigation of some of the remote and neglected districts of the state.

Improved metallurgy and higher prices for base metals have added value to many discoveries which in earlier days were discarded as unprofitable, and the old prospector is being called upon once more to take to the hills and resample some of his early discoveries.

The committee, through M. B. Tomblin, secretary, has issued the following statement:

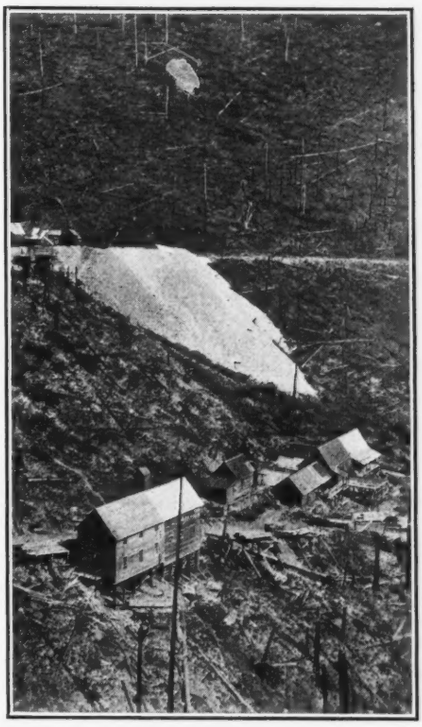
"Believing that in various parts of the state there are districts which hold out great possibilities of developing new orebodies, or possibly a new mining camp, this committee was organized to foster investigation, prospecting, and initial development along this line.

"The committee, for various reasons, is obliged to commence in a very modest way. It has decided first to locate, if possible, several promising districts where conditions are favorable for ore deposition and which seem favorable for developing a new mining camp. To encourage prospecting of these areas, the committee will provide for free identification and assaying of samples, and make other arrangements that will be helpful to the prospector.

"The committee at this time will not be able to undertake any financial obligations, and at present can hold out little hope of being able to directly provide any funds for the purpose of prospecting. The committee will, if desired, undertake through publicity to assist prospectors who have made discoveries of merit to get in touch with parties who may be interested in further development.

"The committee believes that at this time it can be most helpful in endeavoring to create a sentiment that will induce Colorado people to look with more favor and interest upon the development of its mineral resources, and to create an atmosphere that will make it easier for the prospector or claim owner to get the attention of capital; but actual contact, the committee believes, should now as in the past be established by the prospector.

"The committee will welcome any suggestion along the lines indicated above, and in accordance therewith will be glad to co-operate with the prospector to the fullest possible extent."

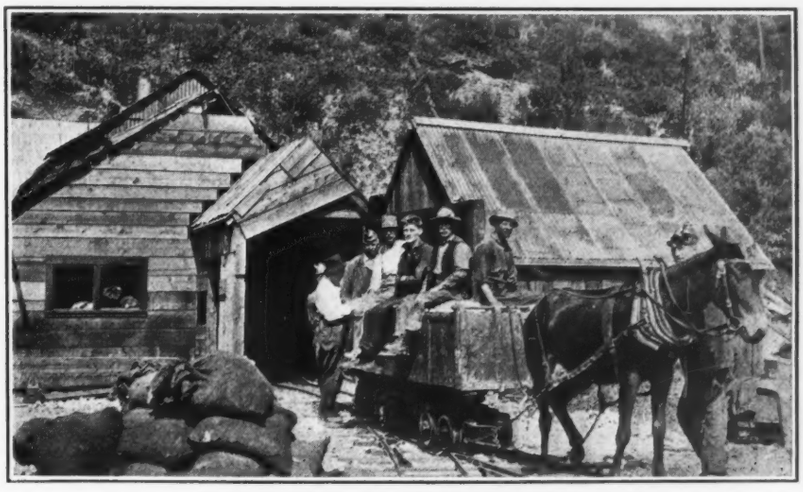


Montana-Idaho company's camp at Adair, Idaho

Many Mines Ship to Trail Smelter in British Columbia

Shipments of ore from a large number of mines to the Trail smelter of the Consolidated Mining & Smelting Co. of Canada reflect the activity in the mining districts of eastern British Columbia and near-by districts in Washington. Most of the small shippers produce lead and lead-silver ore. The following list shows the shippers, the location of the mine, and the tonnage consigned to the smelter during the first four months of 1924:

Source	Tons
Mines of the Consolidated M. & S. Co.	138,269
Bell, Beaverdell	77
Granite Poorman, Granite	11
Millie Mack, Burton	26
Bradley, Nichola	25
Providence, Greenwood	22
Sally, Beaverdell	21
Strathmore, Greenwood	5
Alamo, Slocan	32
Alamo, Zinc	51
Apex, New Denver	23
Bosun, New Denver	20
Bosun, Zinc	68
Charleston, Retallack	26
Cork Province, Zwickey	121
Galena Farm, Silverton	48
Galena Farm, Zinc	71
Hewitt, Silverton	107
L. & T., Slocan City	6
Molly Hughes, New Denver	35
Monitor, Three Forks	35
Mountain Chief, New Denver	28
Ottawa, Slocan City	48
Roseberry Surprise, New Denver	467
Roseberry Surprise, Zinc	278
Ruth, Sandon	224
Silversmith, Sandon	1,176
Silversmith, Zinc	1,408
Standard, Silverton	12
Spokane Trinket, Ainsworth	36
Van Roi, Silverton	10
White Water, Retallic	81
White Water, Zinc	20
Paradise, Windermere	617
Isaac Brisco, East Kootenay	92
St. Eugene, Moyie	29
Knob Hill, Republic, Wash. (gold)	1,026
Lone Pine, Republic, Wash.	1,750
Quilp, Republic, Wash.	2,498



Portal at the mine of the Montana-Idaho Copper Co. at Adair, Idaho

The adit is nearly two miles long and cuts under old workings which have produced in the past

Men You Should Know About

A. E. Bendelari
New President American Zinc Institute

Huntington Adams is in California.

Dr. L. D. Ricketts is in New York.

William Spence Black was in New York last week.

James W. Neill has been engaged to advise upon the concentration of iron ores in Japan.

Milnor Roberts, professor of mining, University of Washington, was in Los Angeles recently.

John C. Greenway has returned to Ajo, Ariz., from the Erupcion district in Chihuahua, Mexico.

John Allen Fulton has been appointed director of the Mackay School of Mines, University of Nevada.

John C. Anderson, of Beverly Hills, Calif., was recently in Grass Valley inspecting mining property.

P. R. Bradley, of the Alaska Juneau Gold Mining Co., has returned from San Francisco to Juneau, Alaska.

William Campbell is now Henry Marion Howe professor of metallurgy at the School of Mines, Columbia University. His title was changed by the trustees in honor of the late Professor Howe.

William Campbell
Howe Professor of Metallurgy, Columbia

Richard N. Hunt, consulting geologist, with offices in Los Angeles, was a recent visitor in Globe, Ariz.

P. V. Roundy and **W. P. Woodring** are at Taft, Calif., making an investigation of Naval Oil Reserve No. 1 for the President's commission.

Roy Trachsel, of Anchorage, Alaska, will this summer visit the Snug Harbor district and investigate the extent of the magnetite deposit there.

James Latimer Bruce, formerly general manager of the Butte & Superior Mining Co. and the Davis Daly Copper Co., will establish offices as a consulting mining engineer in Salt Lake City.

Dr. Robert Harvie has severed his connection with the Geological Survey of Canada for the purpose of engaging in consulting work. During his thirteen years with the survey most of his time was spent in the Province of Quebec, where a thorough examination of the asbestos deposits was made.

Robert Harvie
Recently of the Canadian Geological Survey

Last summer Dr. Harvie made an intimate study of the Rouyn area, the new gold fields of Canada. This is a part of a larger section of country underlain by the pre-Cambrian on which he had previously done four years of field work.

J. Parke Channing, vice-president and consulting engineer for the Miami Copper Co., is visiting the company's property at Miami, Ariz., making his semi-annual inspection of the operations.

T. A. Rickard recently visited the New Cornelia, at Ajo, and will contribute an article on that important enterprise in a forthcoming issue of *Mining Journal-Press*.

William Kelly, president of the American Institute of Mining and Metallurgical Engineers, and **F. F. Sharpless**, secretary, visited the San Francisco local section recently.

H. W. Hardinge sailed on May 9 for London. He goes as a delegate from the A. I. M. E. to the Empire Mining and Metallurgical Congress to be held in London June 3, 4, 5 and 6.

R. W. Stone
Assistant State Geologist, Pennsylvania

R. W. Stone, Assistant State Geologist of Pennsylvania, recently addressed the Professional and Business Women's Club of Harrisburg, Pa., on "Civic Advancement."

Prince Gelasio Caetani, Italian Ambassador to the United States, delivered an address at the commencement exercises of the Golden (Colo.) School of Mines on May 16. It is reported on page 823 of this issue of *Mining Journal-Press*. Prince Caetani will be the guest of the engineers and of the San Francisco Section of the A.I.M.E. at a dinner on May 19, 1924.

R. A. Smith, State Geologist of the Michigan Geological Survey, plans for the season of 1924 supplementary investigation in the iron-bearing district of northern Michigan; beginning of the survey and investigation of the marl deposits of the state; research investigations on foundry sands; investigation and testing of gravel deposits in connection with the state road building; geologic survey of Roscommon and Alpena counties; reinvestigation of the gypsum industry and reinvestigation of the salt industry of Michigan.

Richard A. Smith
State Geologist, Michigan

Societies, Addresses, and Reports

The Engineer's Mentality

Ambassador Caetani's Address Before Colorado Graduates

PRINCE GELASIO CAETANI, Italian Ambassador to the United States and noted engineer, gave the following address at the commencement exercises of the Colorado School of Mines, Golden, on May 16:

Almost exactly twenty-two years ago I landed for the first time on American soil. It was a hot day in June, and Broadway was glaring with sunshine as I rode on a tram to Columbia University to register as a post-graduate student. I received instructions to leave that same day for Park City, Utah. So I did, and three days later I stepped off the train in a typical Western mining camp, where I was received with some curiosity and much cordiality by the students of the Columbia School of Mines, who were following their summer courses at the Daly West mine.

I have purposely evoked this first memory of my American life; it may appear insignificant to you as I tell you about it, but to me, as I look back on what that first step in the engineering profession has represented to me in the course of life, it appears full of meaning.

I have referred to this memory because I feel that it brings me closer to you, many of whom within a few days will go out on the hill to get practical experience, maybe in that same old mining camp where I made my "debut." I wish you to fully understand that I have not come to Golden for the commencement exercises to exhibit a white plumed ambassadorial hat, but just to talk to you as a School of Mines colleague, somewhat senior in years and experience, somewhat worse for wear, but who feels, or at least believes himself to be, not different from what he was when he entered the bunkhouse of the Daly West mine with a pretty gray traveling suit and a stiff white collar.

You may ask me what influence my school and practical training in mining has had in my life. You want to know this because the course of life is still ahead of you, and your mind continuously speculates in an endeavor to guess what it will be. To say the truth, my book of life has so far consisted of several chapters so different one from the other that at times I wonder what has linked them together.

There is first a chapter of a rather wild mining life out West; then a period of constructive metallurgical work; then the hurricane of the war; then two years devoted to agriculture; then a plunge in political life to fight communism, and now the plumed hat of diplomacy.

There is nothing very strange or very extraordinary about this. Life is a series of events that seem to be fatally linked one to the other (somebody said, "Life is one damned thing after another"), as if there were some superior force that predisposes the course of each man's life; this superior force doubtlessly exists, but it is not a mysterious force outside of us but within us, and is the geometric resultant of three elementary forces: will power, intelligence, and character. These three elementary forces may be fairly iso-orientated and you have success; they may be set out at angles of 120 degrees and you have failure.

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Prince Gelasio Caetani
Italian Ambassador to the United States

The intensity of these forces is to a great extent a gift of nature; in some individuals they may be negative, and then they are hopeless cases. But most men have in them a fair supply of each, and the scope of college training is to strengthen and iso-orientate them.

This is the principal object of college and practical training. All the figures and formulas and facts that during the university courses you store in the chest of drawers of your brain are useful equipment for life; often you will find yourself in the necessity of picking them out of the drawers, dusting them and getting the creases out so as to make them fit for use. But this is not the principal advantage derived from college training; what really counts is the polarization to which your mind has been subjected for several years while under the guidance of experienced teachers.

No training is more effective in this sense than the study of science, and especially engineering, which covers all branches of science.

Engineering trains the mind to search always for the truth, the correct fundamental facts underlying every problem. You can muddle up facts in law, in politics, and in diplomacy, but you cannot fudge with facts when you tackle an engineering problem; if you do your steel structure will fall down or your enterprise fail. You can run a bluff in politics and keep it up for a long time before being found out, but you cannot bluff on operating costs, because the bank account will tell on you.

Engineering develops respect for truth and therefore develops an instinctive hatred for demagogy which is nothing else than a lying to yourself to please others. That is why I believe that public affairs the world over would fare much better if they rested less in the hands of politicians and more in those of engineers.

What does a politician do when his constituents clamour for an unwarranted appropriation? He gets up and delivers a flowery speech to persuade his colleagues of the moral reasons that call for the appropriation. What does a mining director say when stockholders clamor for dividends? He answers: "You will get them when the mine will pay," and if he does otherwise he does and should go to the "pen."

Demagogy is an unknown word in the mining community. Acts that in politics are styled as being inspired by demagogic reasons, in mining are quite simply called "swindles."

I am saying all this to emphasize how the engineering schools train the mind toward always searching for the truth and holding to it fearlessly. Engineering stimulates will power and forms character.

I had proof of all this when I went back to my country for the war in October, 1914. Of all the classes of Italian citizens that answered to the duty call, none did so more readily nor accomplished their duty more thoroughly and intelligently than did the engineers. Their roll of honor is long—very long; and the work accomplished by them will remain for centuries a monument to our profession carved in the live rock of the Alps and the Carso.

And when the war was over and a wave of bolshevism struck Italy after having devastated Russia and Hungary, the first men to form a citizens' alliance, later known as "fasci," were the engineers and the college boys.

I don't believe that 5 per cent of the students in engineering schools of Italy have radical ideas; the engineering mind that seeks truth and logic is instinctively adverse to all utopias of Marxism, bolshevism, and "isms" of the kind.

The result is that the engineering elements have greatly co-operated in the victory of Fascismo in Italy. The great spiritual movement known as Fascismo has been upheld by the people of Italy in the recent election with a greater majority of votes than has been cast in any part of the world for many, many years past in favor of any party and of any ideal.

The new house of representatives in Rome contains today a greater percentage of engineers and technical men than I believe any other parliamentary body. The engineers are coming to the front!

Don't torment your mind in guessing what your personal career and destiny may be. You have obtained in this school a training that has fitted you for any such course in life as fortuitous events and your inborn qualities will trace. Don't expect to work invariably in the character of an engineer; you may follow our profession or drift into some other. Be always ready to drop, if necessary, your profession to serve your country, well remembering that even if some day you become a politician or a diplomat, you will never be a demagogue but always remain an engineer.

Recent Technical Publications

Reviews, Abstracts, and References

Recently Discovered South African Platinum Deposits

Platinum in the Waterberg District. By P. A. Wagner and T. G. Trevor. *South African Journal of Industries*, December, 1923. Government Printing and Stationery Office, Market St., Pretoria, South Africa. Price 6d.

In 1923 Adolph Erasmus, while prospecting in the northern Transvaal, made a panning of sand thrown up in an ant heap. He noted a heavy tailing of gray concentrate that lagged behind the gold in his pan. Since the tailing was heavier than the gold he reasoned that it was platinum and this was confirmed by chemical tests. This discovery led to the development of the Waterberg platinum district, which probably contains the most valuable vein deposits of platinum that have been discovered. The deposits are noteworthy on account of their unusual geological surroundings and because they promise to add to the world's supply of an indispensable metal, the reserves of which are altogether inadequate.

The platinum deposits recently described by Wagner and Trevor are about 20 miles north-northeast of Johannesburg and 15 miles northeast of Nylstroom, on the Pretoria-Pietersburg railway. The district contains many small veins of cassiterite, some of which have been mined. A little gold is found in the region, but the platinum deposits do not contain gold and the source of the gold found in the pannings is not known.

The country is an area of sedimentary rocks, felsites, and intruding granite.[1] It is in the midst of the Bushveld igneous complex, which is a gigantic sheet-like mass of igneous rock 250 miles long and over 100 miles wide. This mass is the greatest intrusive sheet or laccolith that is known.

The molten rock, after its intrusion, separated, the heavier part forming norite and other heavy rocks near the bottom of the mass, and the lighter part forming granite near the top. Along the base, associated with the heavier basic rocks, are found great deposits of magnetite and chromite and smaller ones of nickel and copper. Some of the chromite deposits contain noteworthy amounts of platinum. Locally the assays show as much as 1 dwt. per ton, but the platinum in the chromite ores is very erratic in its distribution.

In the vicinity of the platinum deposits on the granite roof of this great igneous rock mass, the granite is intruded into the Waterberg sedimentary rocks, which consist of sandstones, shales, conglomerates, and lavas. The base of the series is a very thick bed of felsite, a light-colored lava, which over hundreds of square miles forms the capping of the granite. The felsite is older than the granite and is intruded by it. Scores of small cassiterite veins are found in the roof of the granite mass, generally within a few hundred feet of the top, and in the felsite and the sedimentary rocks that rest upon the roof.

On the Rooiberg, in the southwest part of the region, deposits of tin, copper, cobalt, nickel, and gold are found also. These occurrences are noteworthy because this is probably the only district known where the series of metals have been deposited on the roof of a laccolith. It offers an opportunity to inspect the groups of metals which are deposited elsewhere at many places around intrusive batholiths, in series or zones, as has been brought out recently by Spurr, Kemp, Rastall, Emmons, and others. In this region the tin deposits are found in the granite near the roof and also in the volcanic and sedimentary rocks that cap the granite, but the other metals are mainly confined to the rocks of the higher series that are above the granite. Some of the deposits are two or three miles from the nearest granite contacts.

The platinum deposits, however, are not in this series, but are of later age than the granite and must be related to a younger intrusive. They are found in a zone of faulting that can be traced for 15 miles. The faults involve the granites, felsites, Waterberg sediments, and the Karroo beds. The latter are Upper Karroo (Permo-Carboniferous), and are later than the Upper Waterberg, which has been shown by Daly and Molengraaf to rest upon the Bushveld granite unconformably.

The principal deposits of platinum are in a quartz impregnated fault zone in the Welgevonden and Rietfontein farms, where it involves the felsite and the Bushveld sandstone. The lode is 6 to 28 ft. wide, has poorly defined walls, and dips about 70 deg. southeast. It is known to carry platinum for 7,600 ft. along its strike. The deposits, according to Wagner, were formed at high temperatures relatively near the surface. The minerals are quartz, sericite, a chrome-bearing chlorite, specularite, and an iron oxide, probably an alteration product of pyrite. The platinum carries 20 to 40 per cent palladium and considerable iridium. Sperrylite is absent.

The quartz is crustified, and some of it forms crusts surrounding fragments of the felsite wall rock. Some of the concentrically banded crusts are very rich in platinum. Large grains of the metal intimately intergrown with specularite commonly form the nucleus of a crust, and the crusts themselves are made up of grains and peculiar wedge-shaped masses of platinum and specularite intergrown with quartz.

The aggregates commonly contain several rudely defined platinum-rich layers separated by barren quartz. The deposition of quartz and of platinum, specularite, and pyrite evidently alternated. The sericite on weathering becomes green, and according to Wagner is probably chromiferous. The chlorite carries about 4 per cent chrome oxide. Some secondary kaolin is present.

The main vein is wide and it carries platinum over a width of 4 ft. and in places the very rich ore contains over 9 oz. to the ton. On the Welgevonden farm it assayed 107 dwt. over 20 in. wide for 50 ft. on the strike. Winzes and pits put down on the main lode in a stretch 480 ft. along the strike have shown that a considerable part of the lode carries platinum in workable quantities.

This discovery perhaps has a certain economic interest outside of the value of the platinum deposits. To the north of the Nylstroom district, extending almost to the Limpopo River valley on the border of the Transvaal, there is a great area of the Waterberg sedimentary rocks, and at many places above the Bushveld igneous complex there are beds of the Karroo which are later than the Waterberg. Valuable mineral discoveries seem to be rare in these rocks in the Transvaal, although to the south of the Transvaal in Cape Colony the diamond pipes are found intruding the Karroo. At Waterberg there is evidence of a noteworthy period of metallization as late as the Upper Karroo (Bushveld sandstone) and therefore later than the main masses of norite and the red granite of the Bushveld igneous complex. It is possible that this period is of the same age as the Bushveld amygdaloid which lies above the Bushveld sandstone in the region east of the Waterberg district.

W. H. EMMONS.

[1] Mellor, E. T.: "The Geology of a Portion of the Waterberg District to the North of Nylstroom." Rept. Geol. Sur. So. Africa for 1909, pp. 53-72, 1910.
Kynaston, H.: "On a Portion of the Waterberg District West of Warmbaths" *idem*, pp. 21-39.

Petroleum—"Industrial Accidents in the California Oil Fields," by H. C. Miller, 22 pages, U. S. Bureau of Mines *Reports of Investigations* No. 2,557, is a statistical study of the safety-first movement. "The Paraffin Problem in Oil Wells," by R. Van A. Mills, 11 pages, No. 2,550, discusses the "paraffining" of oil wells and the methods of preventing and remedying that trouble. No. 2,553, 15 pages, by G. W. Jones, W. P. Yant, and E. P. Buxton, is entitled "Gaseous Content of Ground Waters as an Aid to the Petroleum and Natural Gas Prospector." It discusses how hydrocarbons present in the water may serve to indicate whether oil or gas sands exist in the region through which the waters have passed, and describes a portable field apparatus developed by the Bureau of Mines for removing and analyzing the gases dissolved in the waters. Any of these mimeographed bulletins may be obtained on request to the Bureau of Mines, Washington.

Geological Bibliography — Bulletin 746 of the U. S. Geological Survey, Washington, D. C., Part 1, 1,167 pages, is a bibliography of "Geologic Literature on North America, 1785-1918," by John M. Nickles. It contains references to some 57,000 articles, practically all of which have appeared in American publications. Copies may be obtained free from the Survey so long as its supply lasts; thereafter for $1.25 from the Superintendent of Documents, Washington, D. C. Part 2 is the index to the above volume; price 65c.

New Machinery and Inventions

McBride Amalgamation Process Uses Novel Machine

Has Been Worked on Beach Sands in California and Oregon

BY JAMES W. NEILL

The McBride process, invented by Charles McBride, is an "enforced or assisted" amalgamation method in which an amalgamated plate is supplied with sodium produced by the electrolysis of a salt solution which is also the medium for securing contact of the pulp with the plate. A relatively low current density is used. In addition, an "exciter" called "mackite" is used and is apparently efficacious. Walter W. Brown and H. O. Jacobson, of Arcata, Calif., co-operated with McBride in developing the mechanical and electrical features of the amalgamator.

The device consists of a wooden stave cylinder, within which the plates, ordinary 22- or 24-gage galvanized iron, are inserted, lapped in the direction of the flow. The cylinder is rotated on rollers and is inclined at a low angle, the pulp being fed at the lower and discharged at the upper end. To carry the pulp up grade, a series of staggered rubber flights is inserted in the cylinder, similar in some respects to the flights used in the Akins classifier. The flights are broken at each quarter segment, and each segment is stepped back 2 in. from its neighbor in the spiral. In effect, an interrupted spiral is secured which allows the pulp to flow back at each quarter revolution. The result is to turn the pulp over repeatedly and spread it upon the plates.

The lower end of the cylinder is closed by a disk through which is an opening for the feed pipe. A carbon rod (one electrode) is suspended in the cylinder, above the fins close to the bottom but extending parallel to the longitudinal axis. The amalgamated plates form the other electrode. The cylinder is revolved at a rate so as to give from 100 to 110 linear feet of travel to the plates per minute.

A mechanical feeder is an integral part of the unit. A two-cylinder 8-hp. gasoline engine supplies power for the direct-current generator and operates a centrifugal pump, feeder, and the cylinder. The power required is small. The pulp is screened to 10 mesh or finer. The amalgamator shown in the accompanying illustrations has a cylinder 18 by 72 in. in dimensions and is mounted upon skids for convenience in transportation. It has a capacity of 1 to 1½ tons per hour.

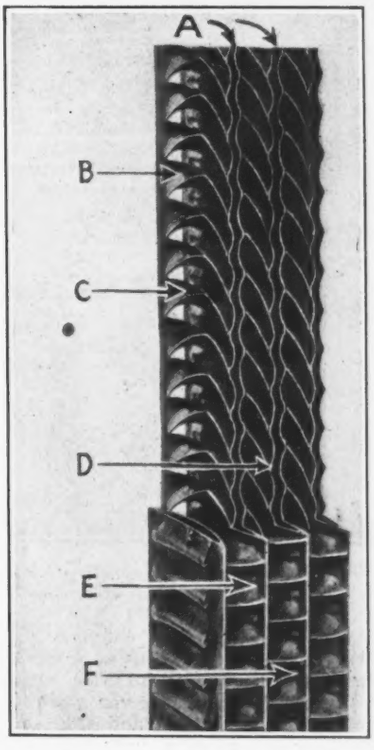
Thus far the machine has been worked only upon the beach sands in California and Oregon. I witnessed the operation of the Brown-Jacobson cylinders on a working scale up to a capacity of 5 cu.yd. per hour, and tests with a gold pan upon the tailing show that the device saves a high proportion of the gold. In my opinion, the amalgamator can best be used in conjunction with the Neill jig where salt water is not available as it is on the coast, and where salt solutions must be made up. The Neill jig would secure a concentration of 8 or 10 into 1 and deliver approximately 20-mesh material suitable for the amalgamator. Under such conditions the loss of salt would not be prohibitive, as the tailing from the amalgamator could be dewatered and part of the salt solution recovered and returned to the amalgamator.

For dredging operations, the device could be used in handling the cleanup sands which are usually removed from the dredge and treated at a separate plant on the shore, where clear water is available. Where the black-sand product is large and there is present both fine gold and platinum, the Neill jig can be used to remove the black sand, and the amalgamator can be placed on the dredge, the flow sheet being so designed as to provide for the recovery and return of the salt solution. The muddy water would not interfere with the operation of the amalgamator.

The action of the current and the liberation of chlorine appear to break up the rusty or greasy coating upon the gold particles as well as to eliminate the effect of oil or grease in the water or material treated. The amalgamated iron plates in the presence of sodium amalgam and the electric current catch the platinum and associated metals when they are present.

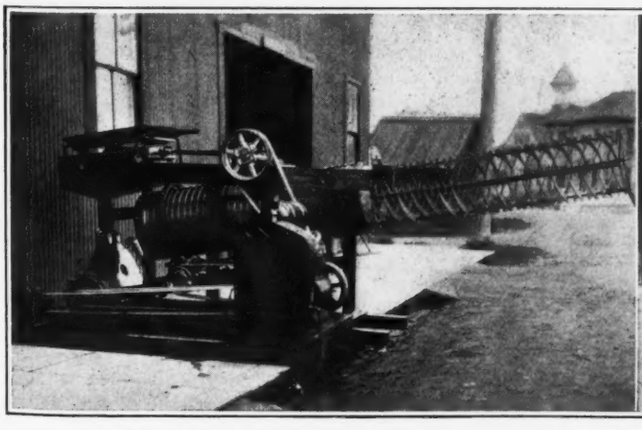
A Radiator Built for Heavy Service

One of the problems in the efficient operation of transportation equipment for the handling of ore or other mine products is that of cooling the motor. A new radiator developed by a Wisconsin manufacturer has particular adaptability to installation on trucks and tractors used for conveying or excavating operations as well as for machinery operated by gasoline motors for hoisting purposes in the mining industries. It has several interesting features. Among them is the spiral,

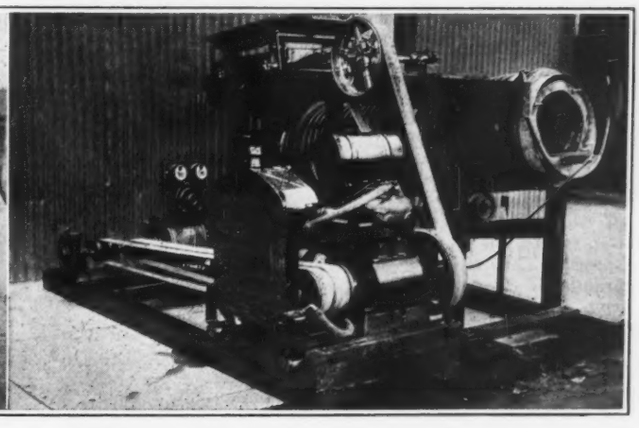


Section showing core construction of radiator

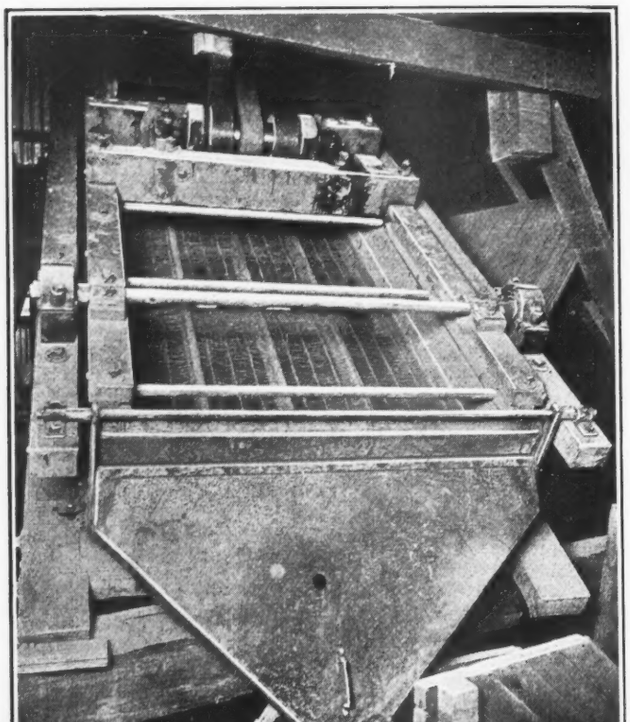
A, extra large water channels; *B*, heavy copper radiator stock adds strength and rigidity; *C*, the spiral construction which is said to give a high rate of exchange of heat from the water to the air; *D*, metallic contact throughout spirals to channels; *E*, channels of one-piece construction; *F*, $\frac{1}{16}$-in. face of solid metal.



Amalgamating cylinder, with plates removed



Amalgamating cylinder, ready for operation



This new vibrating screen uses an unbalanced pulley to produce vibration

formed from a strip of copper, extending from the front to the back through each air cell. The air passing between the water channels is given a whirling motion by this spiral and this serves the more rapidly to accelerate the rate of interchange of heat between the water and air.

The principle of centrifugal action is used to obtain a remarkably high cooling capacity. The spirals are joined to the channels by metallic contact, and this feature adds strength and durability to its construction. The radiator is built in sections so that damaged units may be replaced with the minimum of time and expense. It is manufactured by the Modine Manufacturing Co., Racine, Wis.

Another Vibrating Screen Introduced

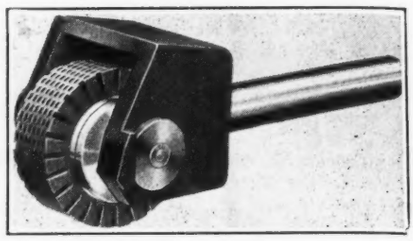
The popularity of vibrating screens is best evidenced by the increasing number of manufacturers who are adding them to their lines. The most recent development in this direction is the new screen put out by the Link-Belt Co. of Philadelphia. In this case the vibrations are produced by means of an unbalanced pulley supported on the screen frame and rotated at high speed. The weights, which serve to unbalance the pulley, can be varied to give the main screen box rapid vibrations of proper intensity and direction to screen different materials. The pulley is provided with a bushing of special composition and automatically oiled by force feed lubrication with no other moving parts than the pulley itself.

At each end of the pulley and integral with it there is a large oil chamber from which the oil is delivered through the hollow stationary shaft to the bushing. An oil pressure gun is furnished with each screen and serves as a gage to determine the amount of oil in the pulley and for supplying oil to it.

The screen box is arranged for one, two or three screen decks, depending upon whether two, three or four sizes of material are produced. Vibrations are imparted directly to the box and to the screen cloth. The cloth, it is claimed, receives the same intensity of vibration over its entire surface, thus avoiding dead areas and zones of varying intensity.

The screen box, with feed hopper and discharge chute, is suspended from two hollow cross shafts, the ends of which are carried on flat spiral springs mounted upon the supporting structure. The screen is belt driven.

Fire Brick. The April bulletin of Laclede-Christy, St. Louis, Mo., will be of interest to those interested in refractories. The front cover shows a striking view of a rotary cement kiln 240 ft. long.



A grinding wheel dresser fitted with roller bearings

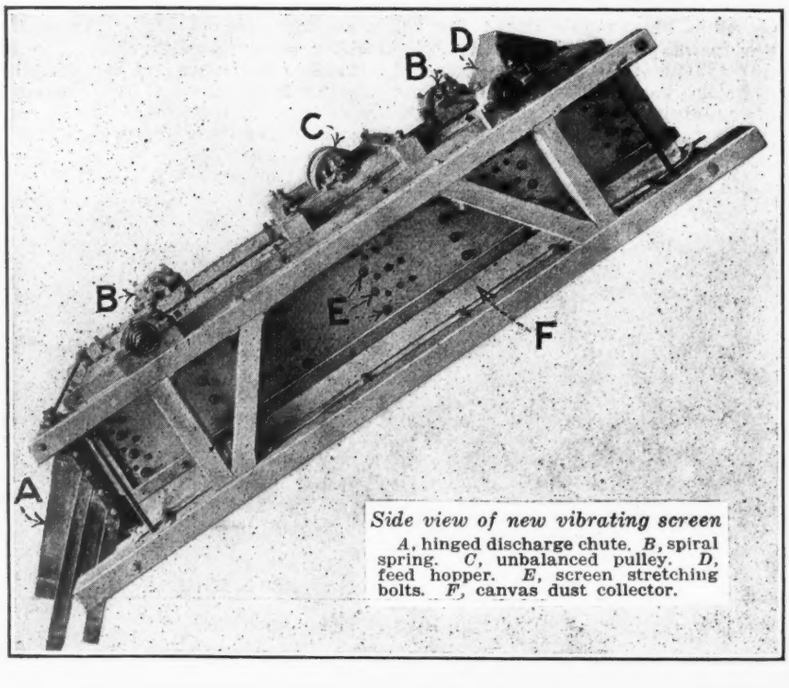
For Dressing Emery Wheels

A rotary type of grinding wheel dresser in which the tool steel disks are carried on roller bearings possesses the advantages of easy running qualities and long life of the bearing. A cage holding the rollers of the bearings is carried by a stud. The cage itself supports a bushing on which the cutters are fastened securely. The cutters have shown only a $\frac{3}{16}$-in. loss and the bearings have shown no wear on a series of fifteen-hour continuous runs. The device may be used either in a tool post or on a magnetic chuck. A shank is used for holding it in a tool post, and the top of the body and the end of the shank rest on the chuck table when used with a magnetic chuck. This device is manufactured by the Desmond-Stephan Manufacturing Co., Urbana, Ohio.

Recent Trade Catalogs

Blowers. Bulletin 21A of the Connersville Blower Co., Connersville, Ind., describes the Victor positive pressure blower.

Electric Furnaces. The Detroit Electric Furnace Co., 2335 First National Bank Building, Detroit, Mich., has issued an eight-page catalog (Bulletin No. 41) describing Detroit electric furnaces for brass melting. Test data included show how foundry costs may be reduced $10 per ton.



Side view of new vibrating screen

A, hinged discharge chute. *B*, spiral spring. *C*, unbalanced pulley. *D*, feed hopper. *E*, screen stretching bolts. *F*, canvas dust collector.

The Market Report

Daily Prices of Metals

May	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
8	13.00@13.125	46.00	46.50	7.35	7.05	5.75@5.80
9	13.00@13.125	46.50	47.00	7.35	7.00	5.80@5.85
10	13.00@13.125	46.75	47.25	7.35	7.00	5.85
12	13.00@13.125	47.00	47.50	7.40	7.10	5.85@5.90
13	12.85@13.00	45.625	46.125	7.40	7.125	5.85@5.90
14	12.75@12.875	45.50	46.00	7.40	7.125	5.85@5.90
Av.	12.998	46.229	46.729	7.375	7.067	5.846

*These prices correspond to the following quotations for copper delivered: May 8th, 9th, 10th, and 12th, 13.25@13.375c.; 13th, 13.10@13.25c.; 14th, 13.00@13.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
8	62 7/8	63 3/4	68 3/4	224	224	27 1/4	26 3/4	29 3/4	30
9	62 5/8	63 1/2	68 1/4	227 1/2	227 1/2	28 1/2	27 5/8	30 3/8	30 1/2
12	62 1/4	63 1/8	68 1/2	229 3/4	229 1/2	29 1/2	28 1/2	30 5/8	31
13	61 7/8	62 3/4	68	225	224 1/4	29 1/4	28 1/4	31 1/4	31 5/8
14	61 3/8	62 1/2	67 3/4	225 1/4	224 3/4	29 3/8	28 3/8	31 1/4	31 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
8	4.35 3/4	64 3/4	33 5/16	94s 3d	12	4.36	65 1/4	33 5/8	94s 8d
9	4.36	65 1/4	33 11/16	94s 7d	13	4.36 1/8	65 1/8	33 9/16	94s 7d
10	4.37	65 3/8	33 1/2	.....	14	4.36 1/2	65 1/4	33 5/8	94s 6d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, May 14, 1924

The metal markets for the week may be characterized as dull rather than weak so far as most of the metals are concerned. Lead and zinc have shown a tendency to advance slightly in the last three days, but copper and tin are somewhat weaker.

Copper

Total sales of copper for the week have not been so large as in the immediate past, though some of the large companies have been in the market for limited tonnages. Most companies were holding at 13⅜c. delivered up to and including Monday and selling copper every day at that price. Two or three other companies found it impossible, however, to get more than 13¼c. With the London market dropping off on Monday, Tuesday, and Wednesday, and foreign business on an exceedingly limited scale, there was more of a tendency to make concessions. Tuesday, copper was freely obtainable in almost any direction at 13¼c. delivered, and at least half a million pounds was sold as low as 13.10c. Today, most of the producers are unwilling to meet the market, which some buyers have forced down as low as 13c.

Despite the favorable April figures, which are given in our news pages, the price continues weak. The good statistical showing is not confined to this country, for a careful estimate for the month of March indicates that the world's production of copper was 121,000 tons, with world consumption at 150,000 tons, consumption thus exceeding production by 29,000 tons, or 24 per cent.

Lead

The official contract price of the American Smelting & Refining Co. continues at 7.50c., New York. Lead has been available all week, however, for considerably less than this price, quotations of 7⅜c. for prompt, 7¼c. for June, and 7⅜c. for July being freely made. Even these prices are reported to have been shaded somewhat on actual business, June lead having been bought last Friday, for example, at 7⅛c., but the market in the East has not been particularly active, and most of the lead has gone to consumers at the official price. In the Middle West, business has picked up somewhat, an effort being made to sell by one or two producers, even though prices were not entirely satisfactory.

In the last three days lead has been perceptibly stronger, owing to better news from abroad. As a result, the inquiries on Monday were heavy. Consumers are watching the market closely, fearing that an upward reaction may find them with a shortage of lead for early use. Production has fallen off somewhat since the price dropped from the peak, but no great decrease is yet apparent; in fact, one producer expects a marked increase in his June supplies. May production of all producers has been almost entirely sold. No particular change can be noted in the class of consuming demand, unless it is that mixed metal manufacturers are taking somewhat less than their usual proportion of the business.

Zinc

Zinc prices have advanced somewhat, as producers are not anxious to sell at present prices so long as ore costs them $39 per ton. One or two distress lots are reported to have been marketed on Thursday and Friday at 5¾c., but most of the business was at higher levels. The week has been characterized by more of a demand for June and July delivery than for May, and sellers have asked about 5 points premium for these later deliveries. The April statistics of the American Zinc Institute show stock of zinc on April 1 at 32,074 tons; produced, 44,949; shipped, 44,245; stock, April 30, 32,778; shipped for export, 3,037; stored for customers, 552; retorts operating, April 30, 82,650. The number of retorts operating increased by about 4,000, which caused some comment, as the production was substantially unchanged. The May figures will no doubt show a somewhat increased production. High-grade continues at from 7⅞@8⅛c., depending upon delivery

point and seller. A good market for this grade is now being found abroad.

Tin

The tin market was fairly active on Thursday and Friday, but since then consumers have not bought heavily. Practically all of the orders are for rush shipments, and the spot price has ranged from one to one and a half cents above that for August-September. Some drain has been made on London for Straits tin, so that the market there is also comparatively bare of supplies. Arrivals so far in May total 1,270 long tons, 135 of which was at Pacific ports.

Circulation Statement

Circulation statement of United States money May 1 follows: Gold coin and bullion, $4,417,401,937; standard silver dollars, $501,919,769; subsidiary silver, $277,510,375; United States notes, $346,681,016; Federal Reserve notes, $2,444,073,880; Federal Reserve Bank notes, $11,581,170; National Bank notes, $777,406,992; total $8,776,575,139. In circulation, per capita, $42.33. Gold and silver reserves increased by $59,000,000 during April, and notes, $33,000,000.

Foreign Exchange

On Tuesday, May 13, closing cable quotations on francs were 5.675c.; lire, 4.445c.; and Canadian dollars, 1¾ per cent discount.

Silver

The market has held steady on reported Continental inquiries, latest advices from London being that present metal price will probably be maintained with small fluctuations for the time being.

Mexican Dollars—May 8, 49⅜; 9th, 49¾; 10th, 49⅞; 12th, 49¾; 13th, 49⅝; 14th, 49¾.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28@29c. per lb.; 98 per cent, 27@28c. London, £125 per long ton.

Antimony—Per lb.:
Chinese and Japanese brands, 8½@8¾c.
W. C. C. brand, 11½@12c.
Cookson's "C" grade, 12½@13c.
Chinese needle, lump, nominal, 8½@9c.
Market dull. China reported firmer.

Bismuth—$2.35@$2.40 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 3d.

Cobalt—$2.50@$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £135 long ton.

Osmiridium—Crude, $58.50 per oz.

Palladium—$83 per oz. Crude, $60 per oz.

Platinum:
Refined, May 8, $115; 9, 10, 12, 13, and 14, $116.
Crude, $112@$113 per oz.
Supplies firmly held. Market quiet with slightly advancing tendency.

Quicksilver — $76@$78 per 75-lb. flask. San Francisco wires $72.65; London, £13½.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given in May 3 issue.

Metallic Ores

Chrome—$19@$22, depending upon grade and source. Nominal.

Manganese—44@46c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum—80c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.
High-grade wolframite, $9@$9.25.
High-grade scheelite, $9.25.
Ordinary grades, $8.60@$8.75. Nominal.
Market exceedingly quiet.

Iron Ore, Magnetite, Tantalum, and **Vanadium** are unchanged from May 3 quotations.

Zinc and Lead Ore Markets

Joplin, Mo., May 10—Zinc blende, per ton, high, $42.85; basis 60 per cent zinc, premium, $40; Prime Western, $39; fines and slimes, $38@$36; average settling price, all zinc ores, $38.22.

Lead, high, $104.65; basis 80 per cent lead, $82.50 offerings; no sales reported. Average settling price, all lead ore, $98.81 per ton.

Shipments for the week: Blende, 13,547; lead, 1,536 tons. Value, all ores the week, $669,750.

The Federal M. & S. Co. has closed down two of its largest producing mines for a period of repair work, and expects to continue this plan for some time. When those now down are restarted others will be closed down. The Vinegar Hill Zinc Co., it is reported, will initiate a similar policy next week. It is estimated these mines, with those with drawing night work, will restrict the output about 1,500 tons per week. (The estimate made two weeks ago of 3,000 tons per week, should have read per month, relating to night shifts only.)

Platteville, Wis., May 10.—Blende, basis 60 per cent zinc, $41 to $42.25 per ton. Lead, basis 80 per cent lead, $91 per ton. Shipments for the week: Blende, 852 tons; lead, 30 tons. Shipments for the year: Blende, 9,246; lead 322 tons. Shipments for the week to separating plants, 1,368 tons blende.

Non-Metallic Minerals

Asbestos:
Crude No. 1—$300@$400.
Crude No. 2—$175@$225.
Spinning fibers—$90@$150.
Magnesia and compressed sheet fibers—$60@$90.
Shingle stock—$50@$70.
Paper stock—$35@$40.
Cement stock—$20@$25.
Floats—$10@$12.
All per short ton, f.o.b. mines, Quebec, tax and bags included.

Diatomaceous Earth—Per ton, f.o.b. plant, California:
Powder, insulation, $30.
Aggregate, natural, $20.
Aggregate, calcined, $50.
Brick, kiln fired, $60.
Filtration powder, $30.

Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Pumice, Pyrites, Rutile, Silica, Sulphur, Talc, Tripoli and **Zircon** are unchanged from May 3 prices.

Mineral Products

Arsenious Oxide (white arsenic)—10c. per lb., nominal. Market dull.

Copper Sulphate—4.90@5c. per lb. Demand recently improved.

Potassium Sulphate, Sodium Sulphate, Sodium Nitrate and **Zinc Oxide** are unchanged from the May 3 prices.

Ferro-Alloys

Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices given in the May 3 issue.

Metal Products

Copper — Sheets, 20¾c. base; wire, 15⅝c.

Lead Sheets—Cut, 11.75c.; full, 11.50c. per lb.

Nickel Silver—18 per cent Grade A sheets, 26¾c.

Yellow Metal—Dimension sheets, 18¼c.; rods, 15¼c.

Zinc Sheets—Base price, $9.50 per 100 lb., f.o.b. plant.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the May 3 prices.

The Iron Trade

Pittsburgh, May 13, 1924

Finished steel prices have been showing more steadiness in the last two or three weeks than might have been expected from the early declines and the obviously bare condition of mill order books. The mills resist price declines more now than they did before the war in a similarly dull market, because they recognize the difficulty prices would have in advancing once they got down. Bars, shapes, and plates are at 2.20c. to 2.30c., depending on locality, tonnage, and specifications.

On the appearance of open market sales of sheet bars at $40, producers having second-quarter contracts have revised to this level, having recently revised from $42.50 to $41.

There is a slight increase in the number of rush orders, and this and other points indicate that liquidation will not take long. The period of overproduction was unprecedentedly short. July will probably as usual mark the low point in production, with a revival thereafter.

Pig Iron.—A sale of basic iron at $21, Valley, confirms the market quotation previously named. Bessemer continues to go in small lots at $22.50, Valley, and foundry at $21.50, but on attractive orders both these prices could probably be shaded 50c. Demand is extremely light. Deliveries are chiefly on very old orders, and merchant furnaces are blowing out.

Connellsville Coke—The market remains stagnant as to new buying. Since April 1 there have been many suspensions of shipment on contract, through furnaces blowing out. Spot furnace coke, $3.60@$3.75; foundry, $4.75@$5.25.

Company Reports

Ray Consolidated Copper Mining Co.

Pursuant to an agreement bearing date Jan. 9, 1924, the properties and assets of Chino Copper Co., as an entirety, were acquired and taken over by the Ray Consolidated Copper Mining Co., as of date Feb. 15, 1924. The annual report of Ray Consolidated Copper Co. for 1923 therefore includes the annual report of Chino for 1923. Hereafter the quarterly and annual reports of Ray Consolidated Copper Co. will cover the operations of the "Chino Mines" division of the Ray Consolidated Copper Co., as well as of the "Ray Mines" division.

For economic reasons beyond control and more or less common to both the "Ray Mines" and "Chino Mines," these properties were operated throughout 1923 at a rate of tonnage that was less than 75 per cent of the nominal and previously demonstrated tonnage capacity of their respective plants and equipments. Furthermore, the price obtained for the resulting limited production of copper was such for a greater portion of the year as to leave an entirely inadequate margin of profit over operating costs, all elements of which continued throughout the year at practically the peak of recent times. Notwithstanding this, the combined operating earnings of the two properties, after deducting all fixed and general charges, except depreciation, which required no cash outlay, were $2,557,734.27.

Statement of Operations

Operating revenue		
Copper produced—61,385,205 lb. @ 14.621c.	$8,975,269.76	
Gold produced — 805,303 oz. @ $20....	16,106.06	$8,991,375.82
Operating expenses		
Mining, including development	$3,359,614.21	
Ore delivery—mine to mill	539,606.54	
Milling	1,728,371.06	
Treatment, freight, and refining	1,940,576.44	
Selling expense	105,122.02	7,673,290.27
Profit from operations		$1,318,085.55
Miscellaneous income		271,452.16
Total income		$1,589,537.71
Charges against income		
Depreciation	$440,076.13	
Loss on property retired	112,939.11	553,015.24
Net income to surplus account		$1,036,522.47
Surplus from Operations		
Balance Dec. 31, 1922		$11,388,919.74
Net income (exclusive of depletion)	$1,036,522.47	
Refund capital stock tax for year ended June 30	49,803.64	1,086,326.11
Balance Dec. 31, 1923		$12,475,245.85

Combined Statement of Assets and Liabilities

	Dec. 31, 1923	Dec. 31, 1922
Assets		
Property and development	$20,422,425.58	$21,129,265.76
Outside investments	2,342,193.83	2,150,008.52
Bond deposit account	85,000.00	
Copper Export Association, Inc.; suspense		368,413.04
Unadjusted debits, prepaid insurance	232,065.78	322,054.44
Material and supplies	1,150,236.24	1,043,861.47
Accounts receivable	544,489.39	425,346.93
Metals in transit	3,999,011.16	2,357,902.55
Cash	2,329,715.45	2,002,492.11
Total	$31,105,137.43	$29,799,344.82
Liabilities		
Capital stock outstanding	$15,771,790.00	$15,771,790.00
Accounts payable	247,061.57	104,206.68
Treatment, charges not due	405,071.38	352,287.79
Reserve for taxes and insurance	540,334.31	461,843.32
Surplus from sale of securities	1,506,646.11	1,506,646.11
Surplus from operations	12,634,234.06	11,602,570.92
	$31,105,137.43	$29,799,344.82

The average cost per net pound of copper produced from mill and from direct-smelting ore for 1923 was 12.03c. per lb., compared with a cost of 12.41c. for the previous year. This cost takes into account credits for the value of gold and silver and miscellaneous income. The costs stated include the usual charge to cover extinguishment of mine development expenditures, which amounts to 15c. per ton of ore, and all operating and fixed and general expenses of every nature, except depreciation.

Chino Copper Co.

The Chino Copper Co. shows a net income of $195,612.95 for 1923, as follows:

Operating revenue		
Copper produced—54,261,2.28 lb @ 14.679c.	$7,965,087.66	
Gold produced — 1,61927 oz. @ $20.....	32,385.39	$7,997,473.05
Operating expense		
Mining, including stripping	$2,343,226.92	
Ore delivery—mine to mill	303,578.91	
Milling	2,631,922.68	
Treatment, freight, and refining	1,828,875.22	
Selling	93,808.19	7,201,411.92
Profit from operations		$796,061.13
Net miscellaneous income		172,135.43
Total income		$968,196.56
Charges against income		
Depreciation for year	$532,961.08	
Loss on property retired	240,622.53	773,583.61
Net income to surplus account		$194,612.95
Surplus from Operations		
Balance, Dec. 31, 1922		$11,726,918.11
Net income for year (exclusive of depletion)		194,612.95
Balance, Dec. 31, 1923		$11,921,531.06

Current assets amount to $5,373,757.01; current liabilities to $4,085,110.60.

The average operating cost per pound of net copper produced for the period, exclusive of charge for depreciation and after crediting precious metal values and miscellaneous income, amounting to 0.37c. per lb., was 12.0c., compared with 11.2c. for the previous year.

Utah Copper Co.

A report of the operations of the Utah Copper Co. for 1923 states that productive operations were continuous throughout the year, although, for the major portion of it, they were limited as to milling capacity on account of Magna plant improvements. The average daily tonnage milled for the period was close to 75 per cent of what will be the regular capacity when this mill is complete and both mills are in full operation. Surplus earned was $10,472,798.69 for the year, corresponding to a rate of $6.45 per share of outstanding stock.

The cost of producing copper was 8.74c. per lb., compared with a cost of 8.71c. per lb. for the previous year. These costs in both cases are exclusive of depletion, but include charges for depreciation, all fixed and general overhead expenses and credits for precious metal values and miscellaneous earnings pertaining to operations.

As previously indicated, the additions and betterments to plants at Garfield are nearly completed. Those at the mines, pertaining chiefly to reconstructing and augmenting power shovels and motive-power equipment, but including extended facilities for disposition of waste overburden and improved housing and living accommodations for employees, are progressing satisfactorily towards the end of placing the mines in secure position for the uninterrupted delivery of 40,000 tons of ore daily, this being the nominal economic capacity which the two mills at Garfield are now nearly prepared to receive.

Statement of Operations

Operating revenue		
Copper produced—195,142,919 lb. @ 14.376c	$28,053,733.46	
Gold produced—72,548,774 oz. @ $20.....	1,450,975.48	
Silver produced—630,940.750 oz. @ 75.910c..	478,944.70	$29,983,653.64
Operating expenses		
Mining, including stripping	$3,930,582.38	
Ore delivery	1,214,802.79	
Milling	6,830,358.54	
Treatment, freight and refining	6,198,656.76	
Selling expense	300,632.09	18,475,032.56
Profit from operations		$11,508,621.08
Miscellaneous income—net		631,640.69
Total income		$12,140,261.77
Depreciation	$1,132,169.31	
Loss on plant and equipment retired	370,304.22	
Miscellaneous—net	164,989.55	1,667,463.08
Net income to surplus account		$10,472,798.69
Surplus from Operations		
Balance—Dec. 31, 1922		$36,497,108.35
Net income for year (without deduction for depletion)		10,472,798.69
		$46,969,907.04
Less capital distributions		6,497,960.00
Balance of surplus—Dec. 31, 1923		$40,471,947.04

Utah Copper Co. Report, Continued

Utah Copper Co., and Bingham & Garfield Ry. Co. Consolidated Statement of Assets and Liabilities

Assets	Dec 31, 1923	
Property and equipment	$39,058,872.23	
Less reserve for depreciation	8,668,903.58	
		$30,389,968.65
Investments		5,937,474.83
Deferred charges to operations		11,608,223.66
Bond deposit account		545,000.00
Current assets		23,359,290.53
		$71,839,957.67
Liabilities		
Capital stock outstanding		$16,244,900.00
Current liabilities		4,965,844.06
Surplus from sale of securities		8,290,620.00
Surplus from operations		42,338,593.61
		$71,839,957.67

Nevada Consolidated Copper Co.

A report of the operations of the Nevada Consolidated Copper Co. for 1923 shows that net earnings for the year, after book entries covering depreciation, were $2,094,676.82, approximately $1.05 per share of stock, and that the net quick assets were increased by $1,223,436.25.

Production of copper increased each quarterly period throughout 1923, as successive units of the concentrating plant could be completed and turned over to the operating department. At the end of the year two units of the mill, having a capacity of 9,500 tons of ore per day, were practically complete and all building foundations and the steel superstructure, including the necessary fine ore bins for the third unit, were in place. The installation of equipment in this unit will progress as rapidly as conditions permit and warrant.

Including depreciation of plant and equipment, all taxes, general and other overhead expenses, the total operating cost per pound of copper produced was 10.92c., after applying, as usual, credits for gold and silver and miscellaneous earnings, as compared with 12.4c. per lb. cost, similarly calculated, for the nine months operating period in 1922.

Combined Statement of Assets and Liabilities

Assets	Dec. 31, 1923	Dec. 31, 1922
Property, equipment and construction	$9,209,419.08	$8,295,119.55
Investments in securities and rights	58,599.23	58,599.23
Deferred charges to mining	5,905,371.63	5,691,376.40
Copper Export Association, Inc.		409,866.77
Bond deposit	150,000.00	75,000.00
Materials and supplies on hand	1,813,989.01	1,619,570.94
Accounts and notes collectible	571,337.56	332,643.03
Deferred accounts	498,316.48	599,947.97
Metals on hand and in transit	5,718,573.92	2,476,334.53
Marketable securities	234,700.00	235,534.00
Cash	1,468,998.53	2,946,593.17
	$25,629,305.44	$22,740,585.59
Liabilities		
Capital stock outstanding	$9,997,285.00	$9,997,285.00
Surplus (from securities sold in excess of par value or cost)	7,071,850.17	7,071,850.17
Accounts payable (not due)	1,120,100.17	807,505.76
Deferred accounts	123,495.09	82,647.01
Unpaid treatment on metals (not due)	610,797.12	363,547.49
Surplus from operations	6,705,777.89	4,417,750.16
	$25,629,305.44	$22,740,585.59

Operating revenue		
Copper produced—61,573,246 lb. @ 14.322c.	$8,818,753.59	
Gold produced—27,889,809 oz. @ $20.534	572,681.85	
Silver produced—71,813.48 oz. @ 75.015c.	53,871.06	
		$9,445,306.50
Operating expenses		
Mining, including proportion of stripping expense	$2,443,278.01	
Ore delivery—mine to mill	470,228.05	
Milling	1,679,914.02	
Smelting	1,647,864.41	
Freight and refining	913,526.36	
Selling commission	77,002.37	
		7,231,813.22
Profit from operations		$2,213,493.28
Miscellaneous income		
Dividends—Nevada Northern Ry. Co.	$300,000.00	
Interest, rentals, and miscellaneous—net	107,303.74	
		407,303.74
Total income		$2,620,797.02
Depreciation		526,120.20
Net income to surplus account		$2,094,676.82

Surplus From Operations

Balance Dec. 31, 1922	$3,781,815.09
Net income for year (without deduction for depletion)	2,094,675.82
Balance of surplus—Dec. 31, 1923	$5,896,491.91

Oriental Consolidated Mining Co.

Gold; Korea

A report of the operations of the Oriental Consolidated Mining Co. for 1923 shows a profit of $32,767.30. A dividend of 50c. per share was paid during the year.

Balance Sheet as of Dec. 31, 1923

Capital and Liabilities

Capital stock ($5,000,000 authorized)			$4,293,900.00
Sundry creditors			44,708.72
Surplus (deficit) Dec. 31, 1922		$298,956.20	
Add income tax paid		7,000.00	
		$305,956.20	
Less profit for fiscal year		32,767.30	
		$273,188.90	
Add dividend paid Oct. 1923		214,695.00	
Deficit surplus Dec. 31, 1923		$487,883.90	
Depreciation	$2,325,000.00		
Depletion	793,505.40		
		3,118,505.40	
Net surplus and reserves			2,630,621.50
			$6,969,230.22

Property and Assets

Mines and property	$4,293,900.00
New construction and development	1,148,392.54
Plant and equipment additions	750,000.00
Cash	312,284.42
Sundry debts	236,071.89
Supplies	209,081.36
Tax to Dec. 31, 1924, paid in advance	12,500.00
Insurance for 1924 paid in advance	6,000.00
	$6,969,230.22

Profit-and-Loss Account for 1923

Dr.	Cost per Ton	Value
Mining costs	$2.58	$621,658.66
Milling costs	.48	116,140.46
Concentrates expenses	.16	38,723.23
Transportation of ore	.04	9,847.65
General expenses	.43	103,178.90
Depreciation	$1.04	$250,000.00
Depletion 5 per cent of output	.26	60,947.36
Total debits	$4.99	$1,200,496.26
Profit for year to balance sheet	.13	32,767.30
	$5.12	$1,233,263.57
Cr.		
Bullion from mills	$2.63	$633,530.00
Concentrates	2.43	585,417.24
Interest and other receipts	.06	14,316.33
	$5.12	$1,233,263.57

A total of 240,939 tons of ore was mined and milled.

Profits gained are materially larger than those of the preceding year and reserves of ore have not been largely diminished. Equipment has not been allowed to deteriorate, and exploration and development in the mines have been vigorously prosecuted.

The fall in the value of the Japanese yen is a serious handicap to the company. There is little probability that it will drop much further. The company will try to obtain authorization to export its bullion.

Production in the period covered by the report amounted to 26,341 tons of concentrate, yielding $585,417.24 in bullion.

North Star Mines Co.

Gold; Grass Valley, Calif.

A report of the operations of the North Star Mines Co. for 1923 states that during the year the production was valued at $741,336.67, and the expenses for current operation amounted to $639,747.79, and for development to $192,032.36, or a total outlay for operation and development of $831,780.15, resulting in a loss of $90,443.48. Sundry expenses at the Champion mines amounted to $1,905.51, and $45,290.87 was received from interest and dividends on invested funds, so that the net current loss for the year was $47,058.12 and the deficit, including allowance for depletion and depreciation, was $250,875.82. One dividend of 2 per cent, amounting to $50,000, was declared as a distribution of capital assets.

Of the total production of the year 82.27 per cent was obtained in the mill by amalgamation, and 17.73 per cent was recovered by cyanidation. It is estimated that the value lost in the tailings was about 27c. per ton crushed. A campaign of active exploration and development work was carried on throughout the year.

Balance Sheet

Assets

Mining property	$3,485,758.75	
Less depletion	3,465,681.45	
		$20,077.30
Homes purchase		3,901.85
Lime and limestone account		1,250.00
Plant and equipment	$1,324,960.19	
Less depreciation	1,102,992.29	
		221,967.90
Rainbow option		
Outlays	$141,251.58	
Production	28,302.71	
		112,948.87
Cash and investments		915,406.97
Total assets		$1,275,552.89
Deficit		849,447.11
		$2,125,000.00

Liabilities

Capital stock (250,000 shares at $10)	$2,500,000.00
Less dividends Nos. 55-69, declared as distribution of capital assets	375,000.00
	$2,125,000.00

Surplus Account

Deficit, Dec. 31, 1922			$598,571.29
Profit and loss, year 1923			
Production		$741,336.67	
Interest and dividends		45,290.87	
		786,627.54	
Operating and development expenses	$833,685.66		
Depletion	179,000.00		
Depreciation	23,635.70		
Investment account: Loss	1,182.00		
		1,037,503.36	
Loss			250,875.82
Deficit			$849,447.11

Magma Copper Co.

Copper; Superior, Ariz.

The Magma Copper Co. reports for 1923 a net loss of $514,480.69, incurred as follows:

Consolidated Income and Expense Statement

Sales of copper		$419,669.33
Cost of sales		520,719.97
		$101,050.64
General and selling expenses and corporate taxes, etc.		102,795.69
		$203,846.33
Interest and other income		58,049.25
		$145,797.08
Railroad net income (loss)		6,256.86
		$152,053.94
Other deductions		362,426.75
Net loss for the year		$514,480.69

Surplus Account

Balance, Jan. 1, 1923		$801,514.58
Refund of taxes and unclaimed wages		3,745.86
		$805,260.44
Deduct railroad loss and tax withheld at source	$155,280.74	
Net loss for 1923	514,480.69	
		669,761.43
Balance, Dec. 31, 1923		$135,499.01

Consolidated Balance Sheet Dec. 31, 1923

Assets

Current assets	$1,090,880.83
Prepaid insurance, interest, and other expenses	21,482.68
Investments in controlled companies	259,026.57
Investments, Apache Powder Co., etc	10,870.00
Fixed assets (*a*)	4,849,828.53
Bond discount and expenses, less amortization	165,737.74
Total	$6,397,826.35

Liabilities

Total current liabilities	$1,329,152.75
Ten 7 per cent convertible gold bonds	3,600,000.00
Reserve for casualty insurance	133,174.59
Common stock—authorized, 350,000 shares of no par value.	
Issued, 240,000 shares	1,200,000.00
Surplus	135,499.01
	$6,397,826.35

(*a*) Smelter expenditure $1,721,104.52.

Production amounted to 6,956,576 lb. of copper, 204,081 oz. of silver, and 2,567.3 oz. of gold.

Facts for the Stockholder

XXXV—Freeport Texas Co.

THE FREEPORT TEXAS CO. was incorporated in Delaware, September, 1913, as a holding company, with power to own, lease, buy, and sell land, mines, wells, and sulphur deposits, to supply water and electric power, to operate pipe lines, and to produce, refine, and deal in sulphur and other mineral and chemical substances. It owns the entire capital stock of the Freeport Asphalt Co., Freeport Sulphur Co., Freeport Terminal Co., Freeport Townsite Co., Freeport Light, Water & Ice Co., Freeport Sulphur Transportation Co., South Texas Stevedore Co., La Espuela Oil Co., S. A., half of the outstanding capital stock and $79,000 of the outstanding $420,000 bonds of the Houston & Brazos Valley Railway Co., one-quarter of the capital stock of Société pour l'Importation et la Vente des Soufress Americains, and $9,380 of the stock of the Sulphur Export Corporation.

The company's properties embrace 8,677 acres of land in Brazoria County, Tex., which includes the sulphur deposits known as Bryan Mound, thoroughly equipped for sulphur mining operations; several thousand acres held under lease in Brazoria County for purposes of development; 630 acres of water-front property along the westerly bank of the Brazos River, upon which it has constructed a 3-mile single-track railroad to its sulphur loading docks; water-works and an electric light and power distribution system in Freeport; a fleet of vessels used for transporting from Mexican ports to Freeport the oil required in the operation of the Freeport Sulphur Co. and the Freeport Asphalt Co.; and extensive leaseholds in Mexican oil fields.

In March, 1922, the Freeport Sulphur Co. entered into a contract with the Texas Co. whereby it secured the latter company's interest in the Hoskins Mound sulphur deposit, situated near the coast about 15 miles northeast of Freeport, and upon which a considerable amount of money had been expended by the Texas Co. in prospecting the deposit. Terms of the contract included the payment of $1 a ton royalty to the land owner, and a contingent royalty to the Texas Co. amounting to 50 per cent of the net profits until the Freeport Sulphur Co. has realized out of the remaining 50 per cent the amount of its plant investment with interest at 6 per cent, and thereafter an amount corresponding to 70 per cent of the net profits. This contract was approved by the stockholders in April, 1922; also, a bond issue to provide funds for the development of Hoskins Mound. Subsequently, $25,528 of these bonds were retired and the balance converted into stock.

During the first half of 1923, a $2,000,000 sulphur-producing plant was completed and placed in operation at Hoskins Mound. In February, 1924, the new plant reached peak production.

In May, 1917, the authorized capital stock was increased from 35,000 shares of $100 par value to 500,000 shares of no par value, which were issued in exchange for the old stock at the rate of 14⅔ shares of new stock for each old share. In April, 1922, the authorized stock was increased to 732,000 shares to provide for bond conversion. On Nov. 30, 1922, there were outstanding 729,844 shares, as at present.

During the past six years the operating results have been as follows: In 1918, net income $3,933,324; in 1919, net income $624,839; in 1920, deficit $38,982; in 1921, deficit $393,902; in 1922 deficit $253,497; in 1923, net income $770,111, equivalent to $1.06 a share.

The dividend record since organization has been as follows: 10 per cent on $2,000,000 capital stock in 1915; 40 in 1916; 20 on $3,500,000 capital, plus $4.50 a share on 500,000 shares in 1917; $3 a share in 1918; $4 a share in 1919, the last quarterly payment of $1 being made Nov. 28, 1919. No dividends have since been paid.

On Nov. 30, 1923, current assets consisted of $773,661 cash and $3,652,034 in inventories, a total of $4,425,695. Current liabilities amounted to $1,288,018, including $1,034,395 in notes, accounts and vouchers payable, and $251,918 in taxes and accrued royalties. Net working capital was therefore nominally $3,137,677, represented mostly by inventories as above indicated.

Price range of the stock has been: High, 64⅜ in 1919; low, 8 in 1924; closing price, 8¾ on May 10, 1924.

INVESTIGATOR.

Mining Stocks

Week Ended May 10, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*15	...	...
Anaconda	New York	22⅞	32⅛	32½	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1¼	1⅛	1¼	...	...
Ariz. Com'l.	Boston	...	...	1⅝	Ja.15, Ja.31	0.50
Calaveras	N. Y. Curb	...	...	1⅝	...	...
Calumet & Arizona	Boston	46½	45½	46½	Mc.7, Mc.24, Q	0.50
Cal. & Hecla (New)	Boston	14⅜	14⅛	14⅛	De. 1, De. 17	0.50
Canario Copper	N. Y. Curb	2 3/16	1⅛	2 3/16	...	...
Cerro de Pasco	New York	46⅛	44⅜	45	Ap. 17, My. 1	1.00
Chile Copper	New York	28¼	27⅜	27⅞	Jn.2, Jn.30, Q	0.62½
Chino	New York	16⅛	16	16	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	2⅛	2⅛	2⅛	...	...
Copper Range	Boston	22	20⅛	21	May, 1923	1.00
Crystal Copper	Boston Curb	73	67	69	...	...
Davis-Daly	Boston	*51	*51	*51	Mar., 1920	0.25
East Butte	Boston	4⅛	4¼	4¼	Dec., 1919	0.50
First National	Boston Curb	27	25	25	Feb., 1919,	0.15
Franklin	Boston	†*70	...	...	...	...
Gadsden Copper	Boston Curb	*40	*40	*40	...	...
Granby Consol.	New York	14	13⅛	14	May, 1919	1.25
Greene-Cananea	New York	...	...	13	Nov., 1920	0.50
Hancock	Boston	†1	...	...	...	...
Howe Sound	N. Y. Curb	2¼	2⅛	2⅛	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	25	24⅛	24⅛	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	2⅛	2⅛	2⅛	May, 1923	0.15
Isle Royale	Boston	15	14⅛	14⅞	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	*98	*92	*95	...	...
Jib Consol.	N. Y. Curb	*18	*15	*15	...	...
Kennecott	New York	39⅛	38⅛	38⅛	Mc.7, Ap. 1, Q	0.75
Keweenaw	Boston	†*50	...	...	...	...
Lake Copper	Boston	1¼	1	1	...	...
Magma Copper	New York	32	31	31	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛	...	...
Mass Consolidated	Boston	†*60	...	...	Nov., 1917	1.00
Miami Copper	New York	22	21⅛	21⅛	My.1, My.15, Q	0.50
Mohawk	Boston	*30	*28	*28½	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8	7⅛	7⅛	De.14, De.31	0.50
Nevada Consol.	New York	13⅛	13	13	Sept., 1920,	0.25
New Cornelia	Boston	18⅜	18⅛	18⅛	My.9, My.26,	0.25
New Dominion	N. Y. Curb	2⅛	2⅛	2⅛	...	...
North Butte	Boston	2⅜	2⅛	2⅛	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	*84	*73	*83	...	...
Old Dominion	Boston	19	18⅛	19	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†117	...	...	Mc.24, Ap.2 Q	1.00
Quincy	Boston	18½	17	17⅛	Mar., 1920	1.00
Ray Consolidated	New York	10	9⅜	9⅜	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*14	*14	*14	...	...
St. Mary's Min. Ld.	Boston	30	28½	29½	Ap.22, My.20	3.00
Seneca Copper	New York	⅛	⅛	⅛	...	...
Shannon	Boston	*40	*31	*40	Nov., 1917	0.25
Shattuck Arizona	New York	5⅛	5⅛	5⅛	Jan., 1920	0.25
South Lake	Boston	...	...	*25	...	...
Superior & Boston	Boston	*74	*74	*74	...	...
Tenn. C. & C. cfs.	New York	7	6⅞	7	De.31, Ja.15, Q	0.25
Utah Copper	New York	68⅛	67⅛	68⅛	Mc.14, Mc.31, Q	1.00
Utah Metal & T.	Boston	*31	*30	*30	Dec., 1917	0.30
Victoria	Boston	†*60	...	...	...	...
Walker Mining	N. Y. Curb	3⅛	3	3	...	...
Winona	Boston	†*15	...	...	...	...
NICKEL-COPPER						
Internat. Nickel	New York	12¼	11½	11⅞	Mar., 1919	0.50
Internat. Nickel pfd.	New York	76	76	76	Ap.17, My.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	4	1⅞	2⅜	...	...
National Lead	New York	132	129½	129½	Mc.14, Mc.31, Q	2.00
National Lead pfd.	New York	113	112½	113	My. 23, Ju. 14, Q	1.75
St. Joseph Lead	New York	24	23⅞	24	Mc. 20, 1924	0.50
ZINC						
Am. Z. L. & S.	New York	8	8	8	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	27½	27	27	Nov., 1920	1.50
Butte C. & Z.	New York	4⅞	4⅞	4⅞	Mai., 1923	0.50
Butte & Superior	New York	16½	15⅞	15⅞	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	4	2½	2⅞	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	138	125	126½	May 10, 1924	2.00
United Zinc	N. Y. Curb	...	...	*25	...	...
Yellow Pine	Los Angeles	80	75	75	Mar., 1924	0.04
SILVER						
Alvarado	N. Y. Curb	1	1	1	...	...
Beaver Consol.	Toronto	...	...	*21½	May, 1920	0.03
Castle-Trethewey	Toronto	†*75	†*74	*74	...	...
Coniagas	Toronto	1.90	1.90	1.90	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*59½	*57	*57	Jan., 1917	0.05
Keeley	Toronto	2.24	2.16	2.20	...	...
Kerr Lake	N. Y. Curb	1⅜	1⅛	1⅛	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	†*11	†*10½	*10½	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.35	1.29	1.29	...	...
McKinley-Dar.-Sav.	Toronto	*13	*12½	*12½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	†3.15	†3.05	3.04	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6½	6⅜	6⅜	Mc.1, Ap.21, Q	0.03½
Ontario Silver	New York	...	...	6	Jan., 1919	0.50
Temiskaming	Toronto	*26	*23	*24	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅜	⅜	⅜	...	...
Alaska Juneau	New York	1⅝	1½	1½	...	...
Argonaut	Toronto	†*51	†*49	*48½	...	...
Carson Hill	Boston	1⅛	1⅛	1⅛	...	...
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3⅛	Mc.3, Ap.10, Q	0.10
Dome Mines	New York	16⅛	15⅛	15⅛	Mc.26, Ap.21, Q	0.50
Golden Cycle	Colo. Springs	1.39	1.30	1.35	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	12.95	12.55	12.70	My. 1, My. 19	0.05
Homestake Mining	New York	50	49	49½	My.10, My.26,	.50
Kirkland Lake	Toronto	†*22½	†*21⅜	*21¼	...	...
Lake Shore	Toronto	3.78	3.71	3.71	My.2, My.15	0.02
McIntyre-Porcupine	New York	15⅞	15⅝	15⅞	Ap. 1, My. 1,	0.25
Newray	Toronto	†*31	†*30½	*30	...	...
Portland	Colo. Springs	61	60	60	Oct., 1920	0.01
Teck-Hughes	Toronto	1.18	1.16	1.17	...	...
Tom Reed	Los Angeles	38⅛	37	37	Dec., 1919	0.02
Tough-Oakes	Toronto	†*68	†*66	65	...	...
United Eastern	N. Y. Curb	*61	*57	*61	Ap 10, Ap.28, Q	0.10
Vipond Cons.	Toronto	1.10	1.08	1.10	...	...
Wright-Hargreaves	Toronto	3.00	2.90	2.99	Mc.15, Ap. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	*68	*65	*68	...	...
Con. Cortez	N. Y. Curb	38	35	38	...	...
Con. Virginia	San Francisco	6⅛	3⅛	5⅛	...	...
Continental Mines	N. Y. Curb	...	...	2⅛	...	...
Dolores Esperanza	N. Y. Curb	*50	*50	*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2	2	2	Mc.28, Ap.5	0.08
Tonopah Belmont	N. Y. Curb	*50	*50	*50	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*22	*22	*22	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2 1/16	2 1/16	2⅛	Mc. 11, Ap. 1	0.05
Tonopah Mining	N. Y. Curb	1⅜	1 1/16	1⅜	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1 1/16	1⅛	1 1/16	...	...
West End Consol.	N. Y. Curb	*50	*48	*50	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*65	*62	*65	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	5⅛	5⅛	5⅛	Mc.; Ap. 2, X	0.15
Bingham Mines	Boston	†15	....	....	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake	...	...	*84	Dec., 1920	0.15
Chief Consol.	Boston Curb	3⅛	3⅛	3⅛	Ap.19, My.1, Q	0.10
Columbus Rexall	Salt Lake	22	21	21	Aug., 1922	0.03
Consol. M. & S.	Montreal	38	34	38	Oct., 1920	0.62½
Daly Mining	Salt Lake	....	....	205	July, 1920	0.10
Erupcion	Boston Curb	2⅛	2⅛	2⅛	Mc. 15, Ap.2, X	0.15
Federal M. & S.	New York	....	....	8	Jan., 1909	1.50
Federal M. & S. pfd.	New York	45⅛	45⅛	45⅛	Fe.26, Mh.15, Q.	1.75
Florence Silver	Spokane	*12⅛	*11⅛	*11⅛	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	8⅛	8⅛	8⅛	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb	*27	*27	*27	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	*8	*8	*8	June, 1921	0.02½
Park City	Salt Lake	4.00	4.00	4.00	Mar., 1924	0.15
Park Utah	N. Y. Curb	....	....	3⅛	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	...	...	*75	Nov., 1917	0.02
Silver King	N. Y. Curb	*2	*2	*2	Ap. 1, X	0.30
Silversmith	Spokane	45	40	40⅛	My. 1, My. 10	0.01
Tamarack-Custer	Spokane	1.90	1.88	1.88	Se.30, Oc. 1, K	0.02
Tintic Standard	Salt Lake	4.00	3.97½	3.97½	Mar. 25, 24, QX	0.15
Utah-Apex	Boston	2⅛	2⅛	2⅛	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	50	47⅛	47⅛	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	⅜	⅜	⅜	...	...
Char. Iron pfd.	Detroit	1	1	1	...	...
Colorado Fuel & Iron	New York	42⅛	37⅛	37⅛	My.10, My.26	Q 2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	27⅛	27⅛	27⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	My.15, Jn. 1	Q 0.62½
Mesabi Iron	N. Y. Curb	3	2⅛	2⅛	...	...
Replogle Steel	New York	8⅛	8	8	...	...
Republic I. & S.	New York	46⅛	44⅛	44⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	86	86	86	Mh.20, Ap.1	QX 2.75
Sloss-Sheffield S.&I.	New York	56⅛	55⅛	55⅛	Feb., 1921	1.50
Sloss-Shef. S.&I.pfd.	New York	...	...	80	De.20, Ja.2, Q	1.75
U. S. Steel	New York	99⅛	96⅛	96⅜	Jn.1, Jn.28	QX 1.75
U. S. Steel pfd.	New York	119⅜	118⅛	118⅛	My.6, My.29, Q	1.75
Virginia I. C. & C.	New York	....	....	41	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York	....	....	74	De.15, Ja.22	2.50
VANADIUM						
Vanadium Corp.	New York	22⅛	22⅛	22⅛	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*25	*20	*25	...	...
ASBESTOS						
Asbestos Corp.	Montreal	27	27	27	Se.29, Oc.15	Q 1.00
Asbestos Corp. pfd.	Montreal	55	55	55	Ap.1, Ap.15,	Q 1.50
SULPHUR						
Freeport Texas	New York	10⅛	8⅛	8⅛	Nov., 1919,	1.00
Texas Gulf	New York	60	59	59	Mh.3, Mh.15	QX 1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅛	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	41⅜	41	41	My.20, Jn.1, Q	0.75
Amer. Metal pfd.	New York	107⅛	107⅛	107⅛	My.20, Jn.1, Q	1.75
Amer. Sm. & Ref.	New York	65⅛	62⅛	63	Ap. 11, My. 1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	101⅛	99	99	My. 9, Jn. 1,	1.75
U. S. Sm. R. & M.	New York	21⅞	20	21	Jan., 1921,	0.50
U.S. Sm. R.&M.pfd.	New York	40	40	40	Apr., 1924, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.